FIFTH BOOK.

CAMPBELL'S

BRITISH AMERICAN SERIES

OF

SCHOOL BOOKS.

Campbell's British-American Series of School-Books

THE

FIFTH BOOK

OF

READING LESSONS.

FOR THE USE OF SCHOOLS IN THE BRITISH-AMERICAN PROVINCES

TORONTO:
JAMES CAMPBELL AND SON.

MDCCCLXVII

PREFACE.

THERE exists among teachers a considerable diversity of opinion, as to the place which a Reading Book ought to occupy in the education of youth. On the one hand, it is maintained that such a book ought to be an epitome of universal knowledge, and that the value of each lesson should be estimated by the amount of information it contains, no matter whether interesting to the reader or not; it is upon this principle that the more advanced volumes of the "Irish National Series" have been compiled. On the other hand, it is contended that the sole and simple aim of a book of this character should be, to teach the art of reading; and many of the most modern School Readers have been prepared in accordance with this view. In the present book, and throughout the whole of the Series, the plan adopted is, to combine the advantages of both systems without their disadvantages, or, in other words, to convey information in an interesting manner, to endeavour to excite and stimulate the curiosity of the scholar to further researches by extracts which shall not merely convey instruction, but will at once attract his attention and convert a study into a pleasure.

The lessons in this, as well as in the other advanced books of the Series, have been selected from the works of authors, respectable not only for their merit but also for their elegance of style; thus preserving the true character of the Series, as intended to teach the Art of Reading. The names of such men as Brougham, Maury, Hugh Miller, Darwin, Dickens, Livingstone, Gosse, Kane, Smiles, Macaulay, Gibbon, Bulwer, Robertson, Warburton, &c., are a sufficient guarantee for the literary character of the work.

One important feature in this and its companion book, the Sixth, to which the attention of teachers is directed, is the systematic arrangement of the subjects, by which it is hoped that the pupil may be led to that most important step towards sound scholarship—the accurate classification of all knowledge acquired.

No attempt has been made to give an *epitome* of any science whatever. Under the headings of the Physical and Historical Sciences, the scholar is systematically and progressively introduced to the broad field of knowledge in these departments, of which the objects are clearly stated, and the boundaries carefully defined in the introductory chapters. Instead of that uninteresting detail which serves but to prejudice the minds of the young against some of the most delightful and elevating studies, the sciences are illustrated by incidents or by examples, and the legitimate curiosity of the scholar is thereby excited and stimulated to obtain a deeper insight into the wonders which are here presented to his fancy. The whole is thickly interspersed with readings in verse from the works of our best poets; and a national tone has been given to the book by the introduction of sketches of the Provinces, &c.

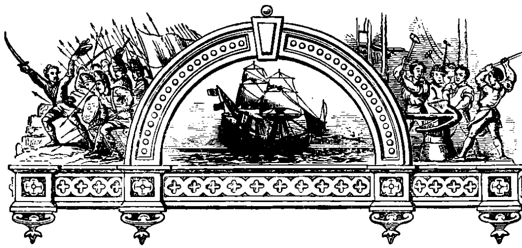
While the lessons are unencumbered with those explanations of commonly occurring words, explanations which reflect upon the teacher, and deprive him at once of a source of pleasure and authority, the etymologies of all scientific terms employed are fully given in the text.

TORONTO, *September* 1866.

CONTENTS.

NATURAL SCIENCES.

MATHEMATICAL SCIENCES.



OUR LAND; OR, THE SONG OF THE FINNISH PATRIOTS.

(*Translated from the Swedish of Runeberg.*)

Our land, our land, our Fatherland!
  Thou glorious word, ring forth!
No mountain rises, proud and grand,
Nor slopes a vale, nor sweeps a strand,
  More dear than thou, land of the North—
  Our fathers' native earth.

Our land is poor, as all can tell;
  No gold our rivers hold;
A stranger scorns its heath and fell,
And yet this land we love full well;
  For us—with mountain, wood, and wold—
  'Tis still a land of gold.

We love our rivers' thundering tide,
  Our streamlets sparkling bright;
The murmuring of our forests wide;
Our starry nights, our summer's pride;
  All, all that e'er, with sound or sight,
  Has fill'd us with delight.

'Twas here our fathers fought the fight,
  With thought, and sword, and plough;
Here—here in moments dark or bright,
'Mid Fortune's smile, or Fortune's spite,
  The Finnish people's heart would glow,
  'Twould bear both weal and woe.

And who could count the struggles dire
  Which that brave people stood,
When battle raged with sword and fire,
And frost and famine spent their ire?
  And who could mete their outpour'd blood—
  Their patient, dauntless mood?

It was for us their life-blood flow'd,
  Here, here upon this shore;
'Twas here with joy their bosoms glow'd,
'Twas here in sorrow they abode;
  Long ere we lived, in days of yore
  Our burdens here they bore.

How blest, how precious, is this spot,
  All that we love is here;
Howe'er hard fate may cast our lot,
A land—a fatherland—we 've got;
  Oh, what on earth can e'er
  Be to our hearts more dear?

And here, yes here, we see the land—
  O sight, how full of bliss!
We need but stretch our good right hand,
And joyous point to sea and strand,
  And say, "Behold this country—this—
  Our fatherland it is."

And were we call'd to dwell in light,
  'Midst golden clouds of morn,
Where thousand stars are glittering bright,
Where tears ne'er flow, nor sorrows blight;
  Still, for this land so poor, so stern,
  Our longing hearts would yearn.

O land! thou land of thousand lakes,
  Of song and constancy;
Against whose strand life's ocean breaks,
Where dreams the past, the future wakes;
  Oh, blush not for thy poverty—
  Be hopeful, bold, and free.

Thy blossom, in the bud that lies,
  Shall burst its fetters strong;
So, from our tender love shall rise
Thy light, thy fame, thy hopes, thy joys;
  And prouder far shall sound ere long
  Our Finland's Patriot Song.

—*Illustrated London News.*

ON THE PLEASURES OF SCIENCE.

To pass our time in the study of the sciences has, in all ages, been reckoned one of the most dignified and happy of human occupations, and the name of philosopher, or lover of wisdom, is given to those who lead such a life. But it is by no means necessary that a man should do nothing else than study known truths, and explore new, in order to earn this high title. Some of the greatest philosophers, in all ages, have been engaged in the pursuits of active life; and he who, in whatever station his lot may be cast, prefers the refined and elevating pleasures of knowledge to the low gratification of the senses, richly deserves the name of a philosopher.

It is easy to show that there is a positive gratification resulting from the study of the sciences. If it be a pleasure to gratify curiosity—to know what we were ignorant of—to have our feelings of wonder called forth, how pure a delight of this very kind does natural science hold out to its students! Recollect some of the extraordinary discoveries of mechanical philosophy. Is there anything in all the idle books of tales and horrors, with which youthful readers are so much delighted, more truly astonishing, than the fact, that a few pounds of water may, without any machinery, produce an irresistible force? What can be more strange, than that an ounce weight should balance hundreds of pounds, by the intervention of a few bars of thin iron?—Observe the extraordinary truths which optical science discloses! Can anything surprise us more, than to find that the colour of white is a mixture of all others; that red, and blue, and green, and all the rest, merely by being blended in certain proportions, form what we had fancied rather to be no colour at all than all colours together?—Chemistry is not behind in its wonders. That the diamond should be made of the same material with coal; that water should be chiefly composed of an inflammable substance;

that acids should be almost all formed of different kinds of air; and that one of those acids, whose strength can dissolve almost any of the metals, should be made of the self-same ingredients with the common air we breathe; these surely are things to excite the wonder of any reflecting mind—nay, of any one but little accustomed to reflect. And yet these are trifling when compared to the prodigies which astronomy opens to our view: the enormous masses of the heavenly bodies; their immense distances; their countless numbers, and their motions, whose swiftness mocks the uttermost efforts of the imagination.

Akin to this pleasure of contemplating new and extraordinary truths, is the gratification of a more learned curiosity, by tracing resemblances and relations between things which, to common apprehension, seem widely different. It is surely a satisfaction, for instance, to know that the same thing which causes the sensation ot heat causes also fluidity; that electricity, the light which is seen on the back of a cat when slightly rubbed on a frosty evening, is the very same matter with the lightning of the clouds; that plants breathe like ourselves, but differently, by day and by night; that the air which burns in our lamps enables a balloon to mount. Nothing can at first sight appear less like, or less likely to be caused by the same thing, than the processes of burning and of breathing,—the rust on metals and burning,—the influence of a plant on the air it grows in by night, and of an animal on the same air at any time, nay, and of a body burning in that air; and yet all these operations, so unlike to common eyes, when examined by the light of science, are the same. Nothing can be less like than the working of a vast steam-engine and the crawling of a fly upon the window; yet we find that these two operations are performed by the same means—the weight of the atmosphere; and that a sea-horse climbs the ice-hills by no other power. Can anything be more strange to contemplate? Is there, in all the fairy tales that ever were fancied, anything more calculated to arrest the attention, and to occupy and gratify the mind, than this most unexpected resemblance between things so unlike to the eyes of ordinary beholders? Then, if we raise our views to the structure of the heavens, we are again gratified with tracing accurate but most unexpected resemblances. Is it not in the highest degree interesting to find, that the power which keeps the earth in its shape and in its path, wheeling round the sun, extends over all the other worlds that compose the universe, and gives to each its proper place and motion; that the same power keeps the moon in her path round the earth; that the same power causes the tides upon our earth, and the peculiar form of the earth itself; and that, after all, it is the same power which makes a stone fall to the ground? To learn these things, and to reflect upon them, fills the mind, and produces certain as well as pure gratification.

The highest of all our gratifications in the study of science remains. We are raised by science to an understanding of the infinite wisdom and goodness which the Creator has displayed in all His works. Not a step can we take in any direction without perceiving the most extraordinary traces of design; and the skill everywhere conspicuous is calculated in so vast a proportion of instances to promote the happiness of living creatures, and especially of ourselves, that we can feel no hesitation in concluding, that if we knew the whole scheme of Providence, every part would appear to be in harmony with a plan of absolute benevolence. Independently, however, of this most consoling inference, the delight is inexpressible, of being able to follow, as it were, with our eyes, the marvellous works of the great Architect of Nature, and to trace the unbounded power and exquisite skill which are exhibited in the most minute as well as in the mightiest parts of His system.

—BROUGHAM.

THE SEA.

"THE sea is His, and He made it," cries the Psalmist of Israel in one of those bursts of enthusiasm in which he so often expresses the whole of a vast subject by a few simple words. Whose else, indeed, could it be, and by whom else could it have been made? Who else can heave its tides and appoint its bounds? Who else can urge its mighty waves to madness with the breath and wings of the tempest, and then speak to it again in a master's accents, and bid it be still? Who else could have peopled it with countless inhabitants, and filled it from its deepest bed to its expanded surface, filled it from its centre to its remotest shores, filled it to the brim with beauty and mystery and power? Majestic ocean! Glorious sea! No created being rules thee or made thee.

There is mystery in the sea. There is mystery in its depths. It is unfathomed, and perhaps unfathomable. What glittering riches, what heaps of gold, what stores of gems, there must be scattered in lavish profusion in the ocean's lowest bed! What spoils from all climates, what works of art from all lands, have been ingulfed by the insatiable and reckless waves! Who shall go down to examine and reclaim this uncounted and idle wealth? Who bears the keys of the deep? Who but He to whom the wildest waves listen reverently, and to whom all nature bows; He who shall one day speak, and be heard in the ocean's profoundest caves; to whom the deep, even the lowest deep, shall give up its dead, when the sun shall sicken, and the earth and the isles shall languish, and the heavens be rolled together like a scroll, and there shall be NO MORE SEA!

In early times, in the scriptural and classic periods, the great oceans were unknown. Mankind—at least that portion whose history has descended to us—dwelt upon the borders of an inland, mediterranean sea. They had never heard of such an expanse of water as the Atlantic, and certainly had never seen it. The land-locked sheet which lay spread out at their feet was at all times full of mystery, and often even of dread and secret misgiving. Those who ventured forth upon its bosom came home and told marvellous tales of the sights they had seen, and the perils they had endured. Homer's heroes returned to Ithaca with the music of the sirens in their ears, and the cruelties of the giants upon their lips. The Argonauts saw whirling rocks implanted in the sea, to warn and repel the approaching navigator; and, as if the mystery of the waters had tinged with fable even the dry land beyond it, they filled the Caucasus with wild stories of enchantresses, of bulls that breathed fire, and of a race of men that sprang, like a ripened harvest, from the prolific soil. If the ancients were ignorant of the shape of the earth, it was for the very reason that they were ignorant of the ocean. Their geographers and philosophers, whose observations were confined to fragments of Europe, Asia, and Africa, alternately made the world a cylinder, a flat surface begirt by water, a drum, a boat, a disk. The legends that sprang from these confused and contradictory notions made the land a scene of marvels, and the water an abode of terrors.

At a later period, when, with the progress of time, the love of adventure or the needs of commerce had drawn the navigator from the Mediterranean through the Pillars of Hercules into the Atlantic, and when some conception of the immensity of the waters had forced itself upon minds dwarfed by the contracted limits of the inland sea, then the ocean became in good earnest a receptacle of gloomy and appalling horrors, and the marvels narrated by those fortunate enough to return, told how deeply the imagination had been stirred by the new scenes opened to their vision. Pytheas, who coasted from Marseilles to the Shetland Isles, and who there obtained a glance at the bleak and wintry desolation of the North Sea, declared, on reaching home, that his further progress was barred by an immense black mollusc, which hung suspended in the air, and in which a ship would be inextricably involved, and where no man could breathe. The menaces of the South were even more appalling than the perils of the north; for he who should venture, it was said, across the equator into the regions of the sun, would be changed into a negro for his rashness; besides, in the popular belief, the waters there were not navigable. Upon the quaint charts of the Middle Ages, a giant located upon the Canary Islands forbade all farther venture westward, by brandishing his formidable club in the path of all vessels coming from the east. Upon these singular maps, the concealed and treacherous horrors of the deep were displayed in the grotesque shapes of sea-monsters and distorted water-unicorns, which were represented as careering through space and waylaying the navigators. Even in the time of Columbus, and when the introduction of the compass into European ships should have somewhat diminished the fantastic terrors of the sea, we find that the Arabians, the best geographers of the time, represented the bony and gnarled hand of Satan as rising from the waves of the sea of darkness—as the Atlantic was then called—ready to seize and ingulf the presumptuous mariner. The sailors of Columbus, on reaching the Sargasso Sea, where the collected weeds offered an impediment to their progress, thought they had arrived at the limit of navigation, and the end of the world. Five years later the crew of Da Gama, on doubling the Cape of Good Hope, imagined they saw, in the threatening clouds that gathered about Table Rock, the form of a spectre waving off their vessel, and crying woe to all who should thus invade his dread dominion. The Neptune of the classics, in short, who disported himself in the narrow waters of the Mediterranean, and of whose wrath we have read the famous mythologic accounts, was a deity altogether bland and *debonnaire* compared to the gloomy and revengeful monopolist of the seas, such as the historians and geographers of the Middle Ages painted him.

And now Columbus had discovered the Western Continent, Da Gama had found an ocean route to the Indies, and Magellan, sailing round the world, had proved its sphericity and approached the Spice Islands from the east. For centuries now, the two great oceans were the scenes of grand and useful maritime expeditions. The tropical islands of the Pacific arose, one by one, from the bosom of the sea, to reward the navigator, or relieve the outcast. For years property was not safe upon the sea, and trading ships went armed, while the armed vessels of nations turned buccaneers. Commerce was by and by spread over the world, and civilisation and Christianity were introduced into the desert and the wilderness. Two centuries more, and steam made the Atlantic Ocean a ferry-transit.

The ocean, then, has a history; it has a past worth narrating, adventures worth telling, and it has played a part in the advancement of science, in the extension of geographical knowledge, in the spread of civilisation and the progress of discovery, which it is eminently worth our while to ponder and digest.

—GOODRICH'S "*The Sea.*"

THE FORGING OF THE ANCHOR.

COME, see the Dolphin's anchor forged; 'tis at a white heat now;
The bellows ceased, the flames decreased; though on the forge's brow
The little flames still fitfully play through the sable mound;
And fitfully you still may see the grim smiths ranking round,
All clad in leathern panoply, their broad hands only bare:
Some rest upon their sledges here, some work the windlass there.
The windlass strains the tackle chains, the black mound heaves below,
And red and deep, a hundred veins burst out at every throe;
It rises, roars, rends all outright—O Vulcan, what a glow!
'Tis blinding white, 'tis blasting bright; the high sun shines not so!
The high sun sees not, on the earth, such fiery, fearful show,
The roof-ribs swarth, the candent hearth, the ruddy lurid row
Of smiths that stand, an ardent band, like men before the foe.
As quivering through his fleece of flame, the sailing monster, slow
Sinks on the anvil—all about the faces fiery grow—
"Hurrah!" they shout, "leap out—leap out," bang, bang the sledges go;
Hurrah; the jetted lightnings are hissing high and low;

A hailing fount of fire is struck at every squashing blow:
The leathern mail rebounds the hail; the rattling cinders strow
The ground around; at every bound the sweltering fountains flow;
And thick and loud the swinking crowd, at every stroke, pant
"Ho!"

Leap out, leap out, my masters; leap out and lay on load!
Let 's forge a goodly anchor, a bower, thick and broad;
For a heart of oak is hanging on every blow, I bode,
And I see the good ship riding, all in a perilous road;
The low reef roaring on her lee, the roll of ocean pour'd
From stem to stern, sea after sea, the mainmast by the board;
The bulwarks down, the rudder gone, the boats stove at the chains,
But courage still, brave mariners, the bower yet remains,
And not an inch to flinch he deigns save when ye pitch sky-high,
Then moves his head, as though he said, "Fear nothing, here
am I!"
Swing in your strokes in order, let foot and hand keep time!
Your blows make music sweeter far than any steeple's chime;
But, while ye swing your sledges, sing; and let the burden be,
"The anchor is the anvil king, and royal craftsmen we."
Strike in, strike in, the sparks begin to dull their rustling red!
Our hammers ring with sharper din, our work will soon be sped.
Our anchor soon must change his bed of fiery rich array,
For a hammock at the roaring bows, or an oozy couch of clay;
Our anchor soon must change the lay of merry craftsmen here,
For the "Yeo-heave-o," and the "Heave-away," and the sighing
seaman's cheer;
When weighing slow, at eve they go, far, far from love and home,
And sobbing sweethearts, in a row, wail o'er the ocean foam.

In livid and obdurate gloom, he darkens down at last,
A shapely one he is and strong, as e'er from cat was cast.
O trusted and trustworthy guard, if thou hadst life like me,
What pleasures would thy toils reward beneath the deep green sea!
O deep sea-diver, who might then behold such sights as thou?
The hoary monster's palaces! methinks what joy 'twere now
To go plump plunging down amid the assembly of the whales,
And feel the churn'd sea round me boil beneath their scourging
tails!
Then deep in tangle-woods to fight the fierce sea-unicorn,
And send him foil'd and bellowing back, for all his ivory horn;

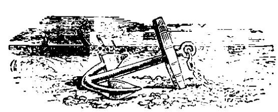
To leave the subtle sworder-fish, of bony blade, forlorn,
And for the ghastly grinning shark, to laugh his jaws to scorn;
To leap down on the kraken's back, where, 'mid Norwegian isles
He lies, a lubber anchorage for sudden shallow'd miles;
Till snorting, like an under-sea volcano, off he rolls,
Meanwhile to swing, a-buffeting the far astonish'd shoals
Of his back-browsing ocean-calves; or haply in a cove,
Shell-strown, and consecrate of old to some Undine's love,
To find the long-hair'd mermaidens; or, hard by icy lands,
To wrestle with the sea-serpent, upon cerulean sands.

O broad-armed fisher of the deep, whose sports can equal thine?
The Dolphin weighs a thousand tons, that tugs thy cable line;
And night by night, 'tis thy delight, thy glory day by day,
Through sable sea and breaker white, the giant game to play.
But, shamer of our little sports! forgive the name I gave,
A fisher's joy is to destroy—thine office is to save.

O lodger in the sea-king's halls, couldst thou but understand
Whose be the white bones by thy side, or who that dripping band,
Slow swaying in the heaving wave, that round about thee bend,
With sounds like breakers in a dream, blessing their ancient friend—
Oh, couldst thou know what heroes glide with larger steps round thee,
Thine iron side would swell with pride, thou 'dst leap within the sea!

Give honour to their memories who left the pleasant strand,
To shed their blood so freely for the love of fatherland—
Who left their chance of quiet age and grassy churchyard grave
So freely, for a restless bed amid the tossing wave—
Oh, though our anchor may not be all I have fondly sung,
Honour him for their memory, whose bones he goes among!

—*Blackwood's Magazine.*



EARLY NAVIGATORS.

We have taken the birth of Christ as a point of departure in the history of navigation, merely because of the prominence of that event in the annals of the world, not on account of any connexion that it has with the chronicles of the sea. So far from that, the first five centuries of the Christian era are an absolute blank in all matters which pertain to our subject. The Roman Empire rose and fell; and its rise and fall concerned the Mediterranean only. Not even Julius Cæsar, the greatest man in Roman history, has a place in maritime records; unless, when crossing the Adriatic in a fishing-boat during a storm, his memorable words of encouragement to the fisherman, "Fear nothing! you carry Cæsar and his fortunes!" are sufficient to connect him with the sea. Neither Pompey, nor Sylla, nor Augustus, nor Nero, nor Titus, nor Constantine, nor Theodosius, nor Attila, can claim part or lot in the dominion of man over the ocean. And so we glide rapidly over five centuries.

Upon the invasion of Italy by the barbarians, A.D. 476, the Veneti, a tribe dwelling upon the north-eastern shores of the Adriatic, escaped from their ravages by fleeing to the marshes and sandy inlets formed by the deposits of the rivers which there fall into the gulf. Here they were secure; for the water around them was too deep to allow of an attack from the land, and too shallow to admit the approach of ships from the sea. Their only resource was the water and the employments it afforded. At first they caught fish; then they made salt, and finally engaged in maritime traffic. Early in the seventh century their traders were known at Constantinople, in the Levant, and at Alexandria. Their city soon covered ninety islands, connected together by bridges. They established mercantile factories at Rome, and extended their authority into Istria and Dalmatia. In the eighth century they chased the pirates, and in the ninth they fought the Saracens. At this period Genoa, too, rose into notice, and the Genoese and the Venetians at once became commercial rivals, and the monopolists of the Mediterranean.

And now Peter the Hermit, barefooted and penniless, inveighing against the atrocities of the Turks towards Christians at Jerusalem, exhorted the warriors of the Cross to take up arms against the infidels. He inspired all Europe with an enthusiasm like his own, and enlisted a million followers in the cause. The passion of the age was for war, peril, and adventure; and fighting for the Sepulchre was a more agreeable method of doing penance than wearing sackcloth or mortifying the flesh. The first Crusade, a motley array of knights, spendthrifts, barons, beggars, women, and children, set out upon their wild career. Then came the second, the third, and the fourth. Crusading was the amusement and occupation of two centuries. Two millions of Europeans perished in the cause before it was abandoned. A few words concerning its effect upon the civilisation of Europe are necessary here, in direct pursuance of our subject.

During their stay in Palestine the Crusaders learned, and in a measure acquired, the habits of Eastern life. They brought back with them a taste for the peculiar products of that region—jewels, silks, cutlery, perfume, spices. A brisk commerce through the length and breadth of the Mediterranean was the speedy consequence. Genoa, Pisa, Florence, Venice, covered the waters of their inland sea with sails, trafficking from the ports of Italy to those of Syria and Egypt. In every maritime city conquered by the Crusaders, trading stations and bazaars were established. Marseilles obtained from the kings of Jerusalem privileges and monopolies of trade upon their territory. Venice surpassed all her rivals in the splendour and extent of her commerce, and it was for this that the Pope, Alexander III., sent the Doge the famous nuptial ring with which, in assertion of his naval supremacy, "to wed the Adriatic." The ceremony was performed from the deck of the *Bucentaur*, or state galley, with every possible accompaniment of pomp and parade. The vessel was crowned with flowers like a bride, and amid the harmonies of music, and the acclamations of the spectators, the ring was dropped into the sea. The Republic and the Adriatic, long betrothed, were now indissolubly wedded. This ceremony was repeated from year to year.

The Normans, the Danes, the Dutch, imitated the example of the Italians, or, as they were then called, the Lombards, but were rather occupied in conveying provisions to the armies than in trading for their own account.

It was during the Crusades that the French navy was created. Philip Augustus, who, on his way to Syria, and thence home again, could not have remained insensible to the advantages of possessing a strong force upon the ocean, formed, upon his return, the nucleus of a national fleet, for the purpose of defending his coasts either against pirates or foreign invasion.

While the necessity of transporting articles from the East to supply the demand thus created in the West, gave a stimulus to commerce and navigation, manufactures were encouraged and developed by the operation of the same cause. The Italians learned from the Greeks the art of weaving silk, which soon resulted in the weaving of cloth of gold and silver. From the manufactories of Syria, where stuffs were made of camels' hair, improvements were introduced into the manufactories of Europe, where they were woven of no other material than lambs' wool. Palestine also suggested to crusaders returning home the advantages of windmills for grinding flour. Arabia furnished the art of tempering arms and polishing steel, of chasing gold and silver, of mounting stones in rich and massive settings. Constantinople furnished the Christians with many splendid specimens of ancient art.

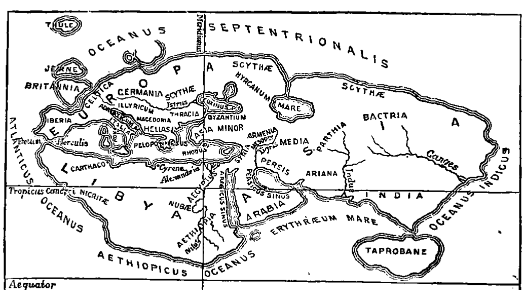
Nearly all the Gothic monuments of Europe which still excite the admiration of the tourist, owe their existence to this communication with the Greeks by means of the Crusades, and to the wonder which seized the Franks and Lombards at the sight of the churches and palaces of Byzantium. Painting upon glass was also brought from Constantinople; and the early painters of Christendom were speedily employed in tracing in colours, upon the windows of abbeys and cathedrals, the exploits of the Crusaders, and the triumphs of the Cross.

From the Arabs and the Greeks, too, the Europeans received their first lessons in the natural and exact sciences. Imperfect and incomplete as were the astronomy, the botany, the mathematics, and the geography of the Arabians, they were far in advance of the same professions as understood and practised in Europe. The languages were improved and enriched by the association and exchange of ideas into which English, Germans, Italians, and French were forced.

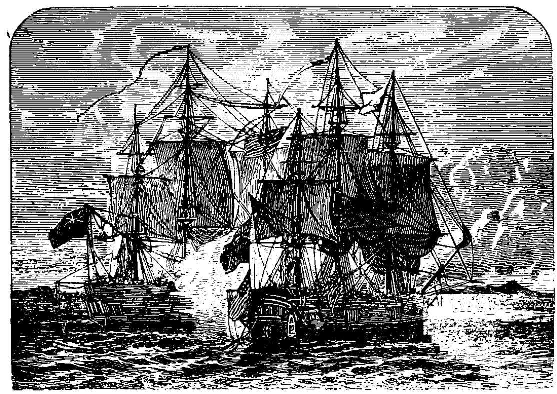
It is obvious, therefore, that the effect of the Crusades was to give the people of Europe a new motive for maintaining an intercourse with the people of Asia. They had seen their superior civilisation, and sought to introduce it among themselves. They had learned to appreciate their skill in the arts, and resolved to acclimate those arts at home. They had accustomed themselves to many articles of luxury, which had become articles of necessity, and which it was now essential, therefore, to transport from the Levant, from the Red Sea, and the Persian Gulf, to the Bay of Venice and the Gulf of Genoa. There was a demand, in short, in the West, for the products, the manufactures, the arts, of the East. Here was the origin of the immense Eastern commerce which now fell into the hands of the Genoese and Venetians, and which resulting from the Crusades, compelled us to the digression we have made

A map, published just anterior to the first Crusade, fully displays the ignorance which then prevailed in geographical science. The sea, as in the age of Homer, is made to surround the world as a river, the land being divided into three parts, Europe, Asia, and Africa. Africa and Asia are joined together in the south, and the Indian Ocean is an inland sea. Asia is as large as the other two continents combined. On the east there is a small spot indicated as the position of the Garden of Eden by the words, *Hic est Paradisus.* Europe and Africa are separated from Asia by a long canal, which may be either the Nile or the Hellespont. Africa is still considered the land of mystery and fable; its northern part only is considered inhabitable, the south being even unapproachable, on account of the torrents of flame poured on it by the sun. The Frozen Ocean, the Baltic, the White Sea, and the Caspian, are all united. The northern regions are represented as forming one single island; and Scandinavia is made the birthplace and residence of the Amazons, the famous women-warriors to whom antiquity had given a home in the Caucasus.

—GOODRICH'S "*The Sea.*"



THE WORLD AS KNOWN TO THE ANCIENTS 200 B.C.



THE CHESAPEAKE AND THE SHANNON.

> And as the war they did provoke,
> We 'll pay them with our cannon;
> The first to do it will be Broke,
> In the gallant ship the *Shannon*."—*Old Song.*

THE 1st of June has long been a glorious day in the annals of the British navy. It was then, in the year 1665, that the Duke of York and Sir William Penn defeated the Dutch Fleet at Solebay; and on the same day, in 1794, Lord Howe gained his famous victory over the French. But the 1st of June upon which our story opens was that of 1813, the second year of the American war. Great Britain had, for many years, been engaged in an unequal contest with the giant power of the first Napoleon; victorious upon her native element, she was also driving his armies from the soil of Spain, and was tasking all her powers in men and money to the utmost, in order to bring a long and exhaustive struggle to a happy conclusion. Taking advantage of her embarrassed situation, the new republic of the United States availed itself of a supposed insult which Great Britain had offered in searching its ships for naval deserters, and declared war on the 18th of June 1812, exactly three years before the battle of Waterloo. Then commenced a sad and unjust war; sad, because it was between people of the same blood and language; and unjust, because the Americans had no real ground of provocation. The United States carried on the war both by land and by sea, invading Canada with their armies, and attacking British frigates and merchant vessels upon the ocean. No large men-of war could be spared from their duty upon the European coast to oppose the ships of the enemy, which, on account of their superior size and armament, had already succeeded in capturing several of the smaller British craft. "England had so long regarded her naval supremacy as indisputable, and had been rendered so confident by a long series of ocean victories, that, at first, she treated the American war with undisguised contempt. On the other hand, the Americans introduced into their military operations the same 'smartness' which characterised their commercial dealings, and, aware of the importance of damaging the world's belief in England's invincibility, they quickly put to sea several powerful men-of-war, heavily armed and fully manned, which they, nevertheless, designated 'frigates' and 'sloops.' It was then with a burst of indignation, wrath, and wonder, that England heard of disgrace after disgrace, disaster upon disaster,—of English frigates captured by American frigates, and English sloops by American sloops—until it seemed as if the boasted prowess of our sailors had suddenly disappeared, and the knell of England's power was to be rung by her youthful and aggressive offspring. The war spirit, which had hitherto slumbered in the Saxon heart, shot up into a sudden flame, and from north to south, and east to west, went forth the cry that the honour of England must be avenged. It was while public feeling was thus unnaturally excited, that a single ship restored the old and just belief in our maritime renown. That ship was the frigate *Shannon*, whose gallant encounter with the *Chesapeake* is one of the most stirring episodes in all our naval history."

"On the 21st of March 1813, Captain Broke sailed from Halifax, in company with a frigate of the same size as the *Shannon*, the *Tenedos*, commanded by an equally zealous officer, Captain Hyde Parker. Looking into Boston harbour, the two British captains saw, to their great delight, two heavily-armed United States frigates, the *President* and the *Congress*, ready for sea. Notwithstanding the disparity of force, they resolved, if possible, to engage the Americans, and took up a station off the harbour to intercept their escape. Meanwhile, by another channel, the American 36-gun-frigate *Chesapeake* had run into port. During a thick fog on the 1st of May, the two

Americans contrived to elude the vigilance of their sentinels, and put out to sea; and the English captains had the mortification of finding only the *Chesapeake* left in the harbour. They were too brave to think of opposing their united strength to a single frigate, and, moreover, it was evident that the *Chesapeake* would hardly venture from her place of shelter to encounter two British ships of war. Captain Broke, therefore, as senior officer, ordered the *Tenedos* to proceed on a cruise, with instructions not to rejoin him until the 14th of June."

During the long month of May the *Shannon* blockaded Boston harbour, waiting for the *Chesapeake* to come out and fight a fair battle upon the open sea. The two ships were well matched, but the advantage was on the side of the American; for, although it had no more guns than the British ship, they were of heavier calibre, and threw not only the legitimate shot and ball, but star and chain shot, with other equally dangerous and barbarous missiles. Its crew, also, was stronger than that of the *Shannon* by seventy men, and the vessel was about seventy tons larger, so that one would have thought Captain Lawrence had little to fear in the event of an encounter. In spite, however, of the many challenges which Captain Broke sent to him during the month of May, he obstinately refused to emerge from his secure position in Boston harbour. About noon, however, on the 1st day of June, just as Captain Broke had sent off a discharged prisoner with a formal challenge to the commander of the *Chesapeake*, that vessel set sail from the harbour, accompanied by a large fleet of pleasure-boats, in which the good people of Boston expected to witness a great naval victory; and so they did, but, unfortunately for them, the victory was on the wrong side. Five long anxious hours were spent by both vessels in getting out into the open sea, so that they might there fight a fair battle upon neutral waters. When about six leagues' distance from the harbour, the *Shannon* lay to and waited for the *Chesapeake* to come within range. On she came with a fair wind, the stars and stripes flying gaily from the mizzen royal topmasthead, the peak, and the main rigging; contrasting strangely with the *Shannon's* plain union-jack at the fore, and her "old rusty blue ensign at the mizzen peak." But old and rusty as the British colours were, they were worth all the bran new bunting in the world, for the flag was there "that has braved a thousand years the battle and the breeze." In addition to the ensigns above-mentioned, the *Chesapeake* hung out at the fore a large white flag, inscribed with the motto, "Sailors' Right and Free Trade," which the Americans foolishly thought would make the British tars turn traitors to their country. About a quarter to six o'clock the *Chesapeake* came up within fifty yards of the *Shannon.*

> " As they drifted on their path,
> There was silence deep as death,
> And the boldest held his breath
> For a time."

Then a cheer arose from the American ship, followed by a shot from the British frigate. Thirteen such single shots passed from vessel to vessel, followed by crashing timbers, and the groans of wounded and dying men. Then the *Chesapeake* poured in a broadside; the *Shannon* replied, and, for a few minutes, the decks of the opposing frigates were swept by the iron hail, driving the men from their quarters in which no human being could live. Now a well-aimed shot, for the *Shannon's* crew are splendid gunners, brings down the steersman of the *Chesapeake;* she falls sharp to the wind, and exposes herself to the full sweep of the British fire. Already Captain Lawrence has fallen mortally wounded, exclaiming, with his last breath, " Don't give up the ship; " for he was a brave man and a good officer. A terrible volley is poured into the sternports of the *Chesapeake,* and the second officer in command wishes to get the vessel away from her gallant British enemy; but Broke will not let him, and so the two ships fall aboard one another. " Lash them together," cries the captain of the *Shannon,* and brave men strive to bind the frigates fast, while the enemy is raining musketry upon them, and Stevens, the veteran boatswain, has his left arm literally hacked off with repeated swordcuts. The rest of the *Shannon's* crew are boarders; the Americans are expecting them, and a large barrel of unslacked lime is at hand to throw in the faces of the British seamen; but, by a just retribution, a shot strikes the barrel, and its contents are dashed into the eyes of those who contrived the cowardly stratagem. In less time than it requires to tell the story, the boarders are ready, seamen with pike, pistol, and cutlass, and marines with musket and bayonet. Over the enemy's taffrail they go, led into action by Captain Broke and Lieutenant Watt, and form upon the deck of the *Chesapeake.* Then follows a scene of confusion and horror, in which shots and cuts and thrusts are succeeded by ghastly wounds and dying groans. The enemy is beaten forward; some escape down the fore hatchway, others over the bow, and others throw themselves into the sea; several surrender as prisoners of war. But the fight is not over. A large number of men are in the hold; they fire through the hatchways and kill a marine. The men who have surrendered take up arms again and attack Captain Broke, one wounding him in the face with a pike, another laying bare his skull with the butt-end of a musket, and a third aiming a blow at him with a cutlass; but his brave seamen cut down the treacherous Americans. Lieutenant Watt now hauls down the stars and stripes, and on the halliards bends a British ensign above them. The halliards are twisted, the stars and stripes rise uppermost, and the *Shannon's* gunners, supposing the act to be performed by the enemy, aim at the lieutenant, who falls, with five seamen, the victims of a melancholy blunder. The marines fire a volley into the hold, where the Americans still keep up a dropping fire upon the victorious enemy. Then follows a summons to surrender from Captain Broke, who, with bandaged head, is sitting upon a gun-carriage. Sullenly they comply, the British flag floats above the American colours, and the *Chesapeake* becomes the prize of her gallant enemy. In this fight the loss of the United States was one hundred and seventy men, that of the British vessel eighty-three.

It was some little time before the shattered frigates were in a fit state to set sail; soon, however, they were repaired and made their way to Halifax. Into that splendid harbour the *Shannon* entered with flying colours and her well-won prize on the 6th of June, amid the booming of artillery and the cheers of loyal British subjects.

"The moral effect of this memorable action, both in England and America, was immense; it restored confidence to the public mind of Great Britain, while it proved to the Americans that they were by no means able to contend with English sailors, when the terms were at all equal. We do not doubt that if a parricidal war should again—which God forbid!—break out between the mother country and the commonwealth, nurtured of her strength and bred from her loins, our seamen would still maintain the honour of the Red Cross, and repeat, if necessary, that gallant encounter between the *Shannon* and the *Chesapeake*, which, in the stirring times of the great war, fired with patriotic ardour the hearts of our forefathers, and reasserted our sovereignty of the seas!"

—*Adapted from* ADAMS's "*Famous Ships of the British Navy.*"

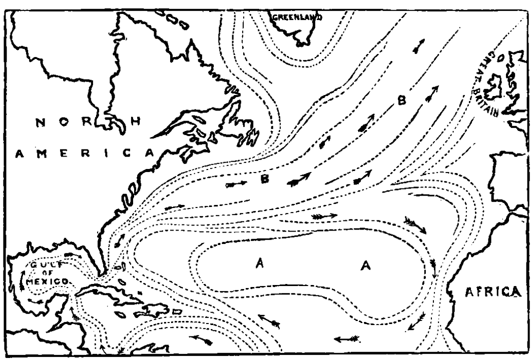
THE CONVICT SHIP.

Morn on the waters! and purple and bright,
Bursts on the billows the flashing of light;
O'er the glad waves, like a child of the sun,
See the tall vessel goes gallantly on;
Full to the breeze she unbosoms her sail,
And her pennon streams onward, like hope, in the gale;
The winds come around her, in murmur and song,
And the surges rejoice as they bear her along.
See! she looks up to the golden-edged clouds,
And the sailor sings gaily aloft in her shrouds:
Onwards she glides amid ripple and spray,
Over the waters, away and away!
Bright as the visions of youth ere they part,
Passing away, like a dream of the heart;
Who, as the beautiful pageant sweeps by,
Music around her, and sunshine on high,
Pauses to think, amid glitter and show,
Oh! there be hearts that are breaking below?

Night on the waves! and the moon is on high,
Hung like a gem on the brow of the sky,
Treading its depths in the power of her might,
And turning the clouds, as they pass her, to light.
Look to the waters! asleep on their breast,
Seems not the ship like an island of rest,
Bright and alone on the shadowy main,
Like a heart-cherish'd home on some desolate plain?
Who, as she smiles in the silvery light,
Spreading her wings on the bosom of night,
Alone on the deep, as the moon in the sky,
A phantom of beauty, could deem with a sigh,
That so lovely a thing is the mansion of sin,
And souls that are smitten, lie bursting within?
Who, as he watches her silently gliding,
Remembers that wave after wave is dividing
Bosoms that sorrow and guilt could not sever,
Hearts that are parted and broken for ever?
Or dreams that he watches, afloat on the wave,
The death-bed of hope, or the young spirit's grave?

'Tis thus with our life: while it passes along,
Like a vessel at sea, amid sunshine and song,
Gaily we glide in the gaze of the world,
With streamers afloat, and with canvas unfurl'd;
All gladness and glory to wandering eyes,
Yet charter'd by sorrow and freighted with sighs:
Fading and false is the aspect it wears,
As the smiles we put on, just to cover our tears;
And the withering thoughts that the world cannot know,
Like heart-broken exiles, lie burning below;
Whilst the vessel drives on to that desolate shore,
Where the dreams of our childhood are vanish'd and o'er.

—T. K. Hervey.



THE GULF STREAM.

There is a river in the ocean. In the severest droughts it never fails, and in the mightiest floods it never overflows. Its banks and its bottom are of cold water, while its current is of warm. The Gulf of Mexico is its fountain, and its mouth is in the Arctic Seas. It is the Gulf Stream. There is in the world no other such majestic flow of waters. Its current is more rapid than the Mississippi or the Amazon, and its volume more than a thousand times greater.

The currents of the ocean are among the most important of its movements. They carry on a constant interchange between the waters of the poles and those of the equator, and thus diminish the extremes of heat and cold in every zone.

The sea has its climates as well as the land. They both change with the latitude; but one varies with the elevation above, the other with the depression below the sea level. The climates in each are regulated by circulation; but the regulators are, on the one hand, winds; on the other, currents.

The inhabitants of the ocean are as much the creatures of climate as are those of the dry land; for the same Almighty hand which decked the lily and cares for the sparrow, fashioned also the pearl, and feeds the great whale, and adapted each to the physical conditions by which His providence has surrounded it. Whether of the land or the sea, the inhabitants are all His creatures, subjects of His laws, and agents in His economy. The sea, therefore, we may safely infer, has its offices and duties to perform; so, may we infer, have its currents; and so, too, its inhabitants: consequently, he who undertakes to study its phenomena must cease to regard it as a waste of waters. He must look upon it as a part of that exquisite machinery by which the harmonies of nature are preserved, and then he will begin to perceive the developments of order and the evidences of design.

From the Arctic Seas a cold current flows along the coasts of America, to replace the warm water sent through the Gulf Stream, to moderate the cold of western and northern Europe. Perhaps the best indication as to these cold currents may be derived from the fishes of the sea. The whales first pointed out the existence of the Gulf Stream by avoiding its warm waters. Along the coasts of the United States all those delicate animals and marine productions which delight in warmer waters are wanting; thus indicating, by their absence, the cold current from the north now known to exist there. In the genial warmth of the sea about the Bermudas on the one hand, and Africa on the other, we find in great abundance those delicate shell-fish and coral formations which are altogether wanting in the same latitudes along the shores of South Carolina.

No part of the world affords a more difficult or dangerous navigation than the approaches of the northern coasts of the United States in winter. Before the warmth of the Gulf Stream was known, a voyage at this season from Europe to New England, New York, and even to the Capes of the Delaware or Chesapeake, was many times more trying, difficult, and dangerous than it now is. In making this part of the coast, vessels were frequently met by snow-storms and gales which mock the seaman's strength, and set at naught his skill. In a little while his bark becomes a mass of ice; with her crew frosted and helpless, she remains obedient only to her helm, and is kept away for the Gulf Stream. After a few hours' run she reaches its edge, and almost at the next bound passes from the midst of winter into a sea at summer heat. Now the ice disappears from her apparel, and the sailor bathes his stiffened limbs in tepid waters. Feeling himself invigorated and refreshed with the genial warmth about him, he realises out there at sea the fable of Antæus and his mother Earth. He rises up and attempts to make his port again, and is again, perhaps, as rudely met and beat back from the north-west; but each time that he is driven off from the contest he comes forth from this stream, like the ancient son of Neptune, stronger and stronger, until, after many days, his freshened strength prevails, and he at last triumphs, and enters his haven in safety, though in this contest he sometimes falls to rise no more.

The ocean currents are partly the result of the immense evaporation which takes place in the tropical regions, where the sea greatly exceeds the land in extent. The enormous quantity of water there carried off by evaporation disturbs the equilibrium of the seas; but this is restored by a perpetual flow of water from the poles. When these streams of cold water leave the poles, they flow directly towards the equator; but, before proceeding far, their motion is deflected by the diurnal motion of the earth. "At the poles they have no rotatory motion; and although they gain it more and more in their progress to the equator, which revolves at the rate of a thousand miles an hour, they arrive at the tropics before they have gained the same velocity of rotation with the intertropical ocean. On that account they are left behind, and, consequently, flow in a direction contrary to the diurnal rotation of the earth. Hence the whole surface of the ocean for thirty degrees on each side of the equator flows in a stream or current three thousand miles broad from east to west. The trade winds, which constantly blow in one direction, combine to give this great Equatorial Current a mean velocity of ten or eleven miles in twenty-four hours."

Were it not for the land, such would be the uniform and constant flow of the waters of the ocean. The presence of the land interrupts the regularity of this great western movement of the waters, sending them to the north or south, according to its conformation.

The principal branch of the Equatorial Current of the Atlantic takes a north-westerly direction from off Cape St Roque, in South America. It rushes along the coast of Brazil; and, after passing through the Caribbean Sea, and sweeping round the Gulf of Mexico, it flows between Florida and Cuba, and enters the North Atlantic under the name of the Gulf Stream, the most beautiful of all the oceanic currents.

In the Straits of Florida the Gulf Stream is thirty-two miles wide, two thousand two hundred feet deep, and flows at the rate of four miles an hour. Its waters are of the purest ultra-marine blue as far as the coasts of Carolina; and so completely are they separated from the sea through which they flow, that a ship may be seen at times half in the one and half in the other.

As a rule, the hottest water of the Gulf Stream is at or near the surface; and as the deep-sea thermometer is sent down, it shows that these waters, though still much warmer than the water on either side at corresponding depths, gradually become less and less warm until the bottom of the current is reached. There is reason to believe that the warm waters of the Gulf Stream are nowhere permitted, in the oceanic economy, to touch the bottom of the sea. There is everywhere a cushion of cold water between them and the solid parts of the earth's crust. This arrangement is suggestive, and strikingly beautiful. One of the benign offices of the Gulf Stream is to convey heat from the Gulf of Mexico,—where otherwise it would become excessive,—and to dispense it in regions beyond the Atlantic, for the amelioration of the climates of the British Islands, and of all Western Europe. Now, cold water is one of the best non-conductors of heat; but if the warm water of the Gulf Stream were sent across the Atlantic in contact with the solid crust of the earth, comparatively a good conductor of heat, instead of being sent across, as it is, in contact with a non-conducting cushion of cold water to fend it from the bottom, all its heat would be lost in the first part of the way, and the soft climates of both France and England would be as that of Labrador, severe in the extreme, and ice-bound.

It has been estimated that the quantity of heat discharged over the Atlantic from the waters of the Gulf Stream in a winter's day would be sufficient to raise the whole column of atmosphere that rests upon France and the British Islands from the freezing point to summer heat.

Every west wind that blows crosses the stream on its way to Europe, and carries with it a portion of this heat to temper there the northern winds of winter. It is the influence of this stream that makes Erin the "Emerald Isle of the Sea," and that clothes the shores of Albion in evergreen robes; while, in the same latitude, the coasts of Labrador are fast bound in fetters of ice.

As the Gulf Stream proceeds on its course, it gradually increases in width. It flows along the coast of North America to Newfoundland, where it turns to the east, one branch setting towards the British Islands, and away to the coasts of Norway and the Arctic Ocean. Another branch reaches the Azores, from which it bends round to the south, and, after running along the African coast, it rejoins the great equatorial flow, leaving a vast space of nearly motionless water between the Azores, the Canaries, and Cape de Verd Islands. This great area is the Grassy or Sargasso Sea, covering a space many times larger than the British Islands. It is so thickly matted over with gulf weeds that the speed of vessels passing through it is often much retarded. When the companions of Columbus saw it, they thought it marked the limits of navigation, and became alarmed. To the eye, at a little distance, it seems substantial enough to walk upon. Patches of the weed are always to be seen floating along the outer edge of the Gulf Stream. Now, if bits of cork or chaff, or any floating substance, be put into a basin, and a circular motion be given to the water, all the light substances will be found crowding together near the centre of the pool, where there is the least motion. Just such a basin is the Atlantic Ocean to the Gulf Stream; and the Sargasso Sea is the centre of the whirl. Columbus first found this weedy sea in his voyage of discovery: there it has remained to this day, moving up and down, and changing its position like the calms of Cancer, according to the seasons, the storms, and the winds. Exact observations as to its limits and their range, extending back for fifty years, assure us that its mean position has not been altered since that time. —Maury.

CHARACTERISTICS OF THE NEW WORLD.

Three centuries and a half ago, in October of the year 1492, Christopher Columbus, while sailing from the extreme west of the ancient continents in hopes of finding a direct route to their extreme east, made the wonderful discovery of a new quarter of the globe.

These three centuries and a half have not divested America of its newness; for the novelty which it possesses consists in something more than the lateness of its discovery. Necessarily the physical features of the Old World are reproduced in the New; but their relative proportions and their arrangement are extremely different.

One characteristic of the New World is the uniformity of its two continental masses. Each of the three continents composing the Old World has an individuality of its own—Europe being remarkable for peninsulas, Asia for table-lands, and Africa for deserts; but North and South America are remarkable chiefly as being the counterparts of each other. They occupy, indeed, different zones, and the Rocky Mountains of North America lie much farther from the coast than the Andes of South America, but all else is correspondence. Both are pear-shaped, and the narrow end of the pear points southwards in each; in both, the principal mountains run north and south, and not far from the western shore; the St Lawrence and Mississippi in North America, correspond in direction to the Amazon and La Plata in South America; the Brazilian group of mountains, which separate these in the lower part of their course, is represented by the Alleghanies, which separate those; and towards the sources of the rivers their basins are separated in North America and in South America alike, only by a gentle undulation, so that, as the inland region of North America, from the Arctic Ocean to the Gulf of Mexico, is but one continuous plain, so also is the inland region of South America, from the Caribbean Sea to Patagonia.

The scenery of these plains, called prairies and savannahs in North America, llanos and pampas in South America, is characterised by the same uniformity which pervades the physical conformation of the whole continent. Whether they are clothed with grass, as on the right bank of the Mississippi, or covered with primeval forests, as on the left bank of that river, and throughout the Amazonian plain, day after day the travellers who explores them has but one unvarying landscape all around him. The deep solitude of these plains, wherever it remains unbroken by advancing civilisation, adds power to the depressing uniformity of the scene. In the following passage, Humboldt, the most learned of travellers, while acknowledging the tendency of American scenery to depress, declares the mind capable of recovering itself, so that, though yielding at first, it conquers at last:—"An uninhabited region appears to the European as a land forsaken by its inhabitants. But he who has lived for years in America, in the forests of the flat country, or on the ridge of the

Cordilleras, and has seen districts equal in extent to France, occupied by only a few scattered huts, finds that even solitudes so wide as these lose their power to depress and to alarm. His fancy becomes familiar with the aspect of a world which nourishes only the plant and the beast of the field, and in which the sounds of human joy or woe are never heard."

Everywhere in the New World, size and simplicity characterise its natural features. Their simplicity results from their size; thus, the river-basins depend on the mountain systems; and both are exceedingly simple, because both are enormously large. The only mountains in the Old World which rival the mountain backbone of America in height are the Himalaya, and none of them can at all compare with it in length; for the American range stretches, with the single interruption of Panama, for 10,000 miles, from Tierra del Fuego to the Arctic Ocean, which is about as far as from Gibraltar to Kamtschatka. The Mississippi and the Amazon, including their longest respective affluents, viz., the Missouri and the Ucayali, are the longest rivers in the world, each of them measuring about 4000 miles, which is nearly a thousand more than the Yang-tse-kiang, the largest river in the Old World. The plains, as has been mentioned, extend, like the principal mountains, throughout the whole length of both Americas. The lakes of Canada are inland seas. Lake Superior, the largest of them, though not the largest inland sea, for it yields in extent to the Caspian and the Sea of Aral, is yet the largest collection of fresh water; and the five great Canadian lakes together are believed to contain more than half of all the fresh water on the globe. The American waterfalls also take precedence of all others. The roar of Niagara can be heard at a great distance, and the cloud formed by its spray can be seen at a distance of ninety miles. Scarcely less remarkable are the cataracts of the Madeira, in South America, near the Peruvian frontier. There are nineteen of them, and at the eighteenth the whole river, about half a mile wide, is poured over a rock one hundred feet high. For volume of water this fall is believed to be the largest in the world, not excepting Niagara. The American forests, too, are on a magnificent scale. The largest covers the whole basin of the Amazon and its tributaries. Humboldt calculates its area as being twelve times that of all Germany.

The aboriginal inhabitants of the New World present, like the regions they inhabit, a remarkable uniformity of type. The Esquimaux, who occupy the extreme north, being excepted, a single native race is spread over North and South America; and the nations composing this race have scarcely any distinctive national character. The aboriginal population of America offers no such contrasts as those between Caucasian and Negro; between Anglo-Saxon and Chinese; perhaps not even a difference so great as that between the Northern and Southern European. The mode of life in Mexico and Peru, the only two countries which had risen above barbarism prior to the discovery of America by Columbus, was of course very different from that of the other Indians, who lived chiefly by hunting; for the Mexicans and Peruvians practised most of the useful arts, had constructed good roads, and had built for themselves cities and temples. But they both stopped short at the same level of attainment, and, which is unexampled in the history of the Old World, they had both arrived at the agricultural stage without passing through the pastoral. The Mexicans had no domestic quadrupeds at all; the Peruvians had only the llama, a poor creature, though called the camel of the Andes, which has since been superseded by the mule as a beast of burden, and is now reared only for its wool, called *alpaca.* Such being the case, the value of milk was unknown, and the pastoral stage of civilisation impossible in America.

The native civilisation of America was not strong enough to effect even a compromise with that of Europe. The Spaniards, overbearing right by might, made their discovery of Mexico and Peru the occasion of an attack, which resulted in the complete destruction of every institution native to the soil. Throughout the rest of America barbarism prevailed. Accordingly, the present civilisation of the New World simply repeats that of Europe, or rather of those European countries which have at any time obtained an extensive footing in America, viz., of Spain, Portugal, Great Britain, and France. Though less uniform than that which preceded it, this civilisation is yet less varied, not only than that of the old World, but than that of Europe. Domestic slavery, that great blot in the aspect of the United States, and the Brazilian empire, is the only American feature which does not find its counterpart in Europe. Europeans were certainly not guiltless of this wrong at its commencement, but for a long time now all Europe, excepting only Spain, which cannot protest against a system maintained in her own islands of Cuba and Porto Rico, has protested by word and deed against its continuance. The American slave-holders, however, not only retain negro slavery as a lucrative inheritance, but defend it as an institution sanctioned by reason and revelation.*

* Slavery is now abolished in the United States.

Neither Spain nor Portugal now retains a single foot of ground on the American mainland. It is worth noting that the former Portuguese possessions have been kept together, whereas the former Spanish possessions have fallen asunder into numerous republics, which are in a state of chronic revolution. A portion of Guiana is all that France now possesses on the American mainland, but a French element still prevails in Lower Canada, and in several of the southern states of the Union. British America is nearly as extensive as the territory of the United States; and a British element, in respect of race, language, literature, religion, education, and manners, prevails, not only throughout what still are, but also throughout what formerly were, British possessions, viz., the greater part of the United States.

As the British element is the most widely distributed in America, so it is also inherently the most powerful. The Spaniards and Portuguese have freely mingled their blood, the former with that of the Indians, the latter with that of the negroes. The majority of the inhabitants in some of the Spanish republics are of Indian descent; and in Brazil six-sevenths of the population consists of negroes and mulattoes, the whites amounting to little more than a million. The French have mingled their blood more sparingly than the Spaniards and Portuguese with the non-European races in America, and the British more sparingly still. The British race alone has been able, not only to maintain but rapidly to multiply, its numbers in the New World. It is also the only race there which, instead of merely following in the wake of European civilisation, keeps pace with it, and even contributes to its development.

—Dr Clyde.

WHERE IS THE BRITON'S HOME?

Where is the Briton's home?
Where the free step can roam,
Where the free sun can glow,
Where a free air can blow,
Where a free ship can bear
Hope and strength; everywhere
Wave upon wave can roll—
East and west—pole to pole—

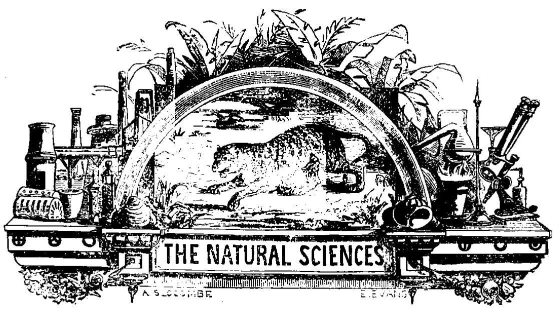
Where a free step can roam—
There is the Briton's home!

Where is the Briton's home?
Where the brave heart can come,
Where labour wins a soil,
Where a stout heart can toil—
Any fair seed is sown—
Where gold or fame is won,
Where never sets the sun,
Where a brave heart can come—
There is the Briton's home!

Where is the Briton's home?
Where the mind's light can come,
Where our God's holy word
Breaks on the savage herd—
Where a new flock is won
To the bright Shepherd-one,
Where the church-bell can toll,
Where soul can comfort soul,
Where holy faith can come—
There is the Briton's home!

Where is the Briton's home?
Where man's great law can come,
Where the great truth can speak,
Where the slave's chain can break,
Where the white's scourge can cease,
Where the black dwells in peace,
Where, from His angel-hall,
God sees us brothers all—
Where light and freedom come,
There is the Briton's home!

—BULWER



THE youngest reader of this book will easily understand the difference that there is between natural and artificial objects. The great Creator of all things has placed mankind in a world of earth and air and sea, of rocks and plants and living creatures; this is the natural world. But man could never supply all his wants or provide for his comfort without making some alteration in the form and character of these objects in the natural world; this he accordingly does, and the materials, thus changed and fitted for the conveniences of human life by the labour of his hands, are called artificial. The pine-tree in the forest, the clay which lies under the soil, and the limestone in the quarry, are the works of Nature; but the house, whether built of timber, bricks, or stone, is a work of Art. Everything, then, in the wide world, belongs to one or other of these two great classes of natural and artificial objects.

Let us, for the time, strive to forget the existence of all that is artificial; this will not be a very difficult task for those who live in the country. Away with shops and houses, bridges and boats, roads, fences, and everything that bears the impress of man's hand upon it. Look around now, and see what still remains with us. Above is the blue sky, partly hidden by fleecy clouds, lit up during the day by the brilliant beams of the sun, at night by the pale-faced moon and all the stars of heaven. Around us is the air we breathe, and without which we and all other living beings would soon cease to exist. Sometimes it is silent and almost motionless, while at others it moves gently along as a summer breeze, or rushes fiercely on its path, a tempestuous whirlwind; through its invisible body the clouds roll their thunders, flash their lightnings, and send down hail, snow, and rain, to protect and water the earth. Tall forests of pine and oak, of birch and maple trees, raise their green summits over the shrubs and wild flowers, ferns and mosses, that cover the ground; through their tangled mazes, four-footed animals, birds, reptiles, and insects, run and fly and crawl; and in the mighty ocean which beats upon the shore, in the lakes and rivers which divide the empire with the land, other plants and animals, with all the finny tribes, find a suitable habitation. But this is not all. Beneath our feet is the great earth's crust, consisting of broad layers of sand and clay, rock, slate, and gravel, traversed by rich metallic veins; and, firmly imbedded in their surface, lie the record of many thousand years, in the shape of fossil plants and animals, that once peopled with life the face of our old mother Earth.

Such are the works of Nature, some of which, at least, we meet with in their natural state every day that we live, and which afford the materials for those artificial objects upon which the ingenuity and activity of mankind are exercised.

From a very early period in the history of the world, men have examined these objects, have studied their nature and properties, have classed them according to their resemblance to one another, and, collecting all the information they could concerning them, have formed sciences or systems of knowledge.

The total number of the sciences and their subdivisions is very large, as you will hereafter learn; but we shall at present turn our attention only to five of them, commonly called the Natural Sciences. Remember, now, all those objects which we found to remain with us after carefully excluding the works of man. They were the heavens above us, the earth with its minerals and rock masses beneath our feet, and around us plants and animals and the invisible atmosphere. The first of these—namely, the heavens—we shall not consider at present, because Astronomy, the science that treats of them, belongs to what you will afterwards become acquainted with as the Mathematical sciences. Let us, therefore, keep our eyes from wandering out of the world we live in, and endeavour to understand how it is, that the many natural objects which meet our view are all comprised within the small compass of five sciences.

One of the earliest objects that would naturally strike a man of observant mind is the ground he walks upon, in its diversified forms of mountain, plain, and valley, with the seas, lakes, and rivers that flow over many parts of its surface. Digging far down below the soil, he would find regular beds of black earth and clay, of sand and rock, lying evenly upon one another, as if a master mason had laid their great foundations with scrupulous care. He picks up a piece of stone, finds in it curious petrified figures of shells and corals, and strange creatures that do not now exist in the world, and wonders how they came there, so far below the surface of the earth. At other times he stumbles upon a great vein or fissure in the solid rock, containing lead or tin, iron or copper ore; or, perhaps, falls in with vast beds of coal, and sees, rising erect through the grimy mass, ferns and cones and trunks of trees, all of the same black material. Then he asks himself the questions—What are all these things? Where did they come from? At what time, and for what purpose, were they created? As soon as he sets his mind and his eyes to work to answer these interesting questions, he has become a student of the science of Geology.

The term Geology, like most names of sciences, consists of two Greek words, and means *a discourse about the earth.* Just as one cordial friend cheerfully communicates information to another, so will our good friend Geology, if we are really desirous to learn, discourse pleasantly to us about the earth, and tell us all that man has hitherto discovered as to its character and history. It is a mistake to suppose that this science has to do only with the rock masses that occur within the earth; everything upon our globe that is *unorganised* or without life, whether land or water, earth or rock, metals or fossils, coal or amber, volcanoes or mineral springs, all belong to the science of Geology. You will afterwards learn more fully what are the special objects of this youngest of the natural sciences in its subdivisions of Physical Geography, Mineralogy, and Geology proper.

Although we naturally imagine that man would early turn his attention to the study of Geology, this is not the case. Long before men thought of examining the crust of the earth, they had made themselves familiar with the several objects composing the beautiful mantle of verdure that nature has thrown over its otherwise bare and uninviting surface. Far away, in the Eastern birthplace of our race, they saw

> "The feathery palm-tree rise,
> And the date grow ripe under sunny skies;"

or the great banian, the fig-tree of India, sending down roots from his giant branches, and, like a broad, living tent, spreading his cool shade over a circumference of 1500 feet. In more western lands a different sight awaited them; there they beheld the orange groves of

Italy, the chestnut forests of Spain, the vine-clad hills of Portugal, the apple orchards of France, and the linden avenues of Germany, with the English oaks, the Scotch firs, and the Norway pines, that adorn the landscapes of these northern countries. Crossing the ocean to the shores of this great Western continent, covered with thick forests of maple and birch, tamarack and balsam trees, what new objects of interest in the plant world must have greeted them. Then, when other distant lands had been explored, and the productions of other climes had been pressed into the service of men for the supply of their luxuries, how interested must they have been in the tea and coffee plants of China and Arabia, the cotton shrub of the East, the scarlet geraniums of the Cape of Good Hope, the variegated fuchsia of Mexico, and the vast variety of shrubs and flowers that please the eye and minister to the wants and enjoyments ot man. What a mine of wealth appeared to them in the great family of the grasses, from the gigantic bamboo, sixty feet high, to the delicate meadow grass, six inches in length; and what objects of wonder and admiration in the graceful fern, the velvety moss, the dry lichen, the fleshy mushroom, and the floating seaweed! But the number of these objects of the vegetable world was too vast, too overpowering, for the memory of man. No sooner had he acquired the knowledge of some new plant than the old ones vanished away; and he put to himself the question, "How can I remember all these objects, and distinguish them from one another?" You have, no doubt, already guessed his answer to this self-put question. It was—"by carefully examining the form and structure of every plant; by comparing them with each other; and, finally, by arranging them in groups or classes according to their points of resemblance." And thus the science of Botany was commenced.

Botany is a Greek word, and, in that language, simply means *a plant;* so that the science of Botany is the *system of knowledge about plants.* What more simple, beautiful, and interesting study could there be than that of Botany? The materials for it are all around us, in fields, and on the road-sides, in woods and gardens; even a vacant town-lot, overgrown with rank weeds, contains sufficient variety to occupy and interest a botanist for whole weeks and months. No country affords greater opportunities for the study of this science than the one we live in; and, among civilised regions, there are very few in which the labours of the botanist will be better rewarded by the discovery of unknown plants, or of interesting particulars regarding those already known.

Plants, however, were not the only, nor, perhaps, the first natural objects that attracted the attention of man. If he were an Egyptian, a worshipper of animals, his were the wary crocodile and the sacred ibis of the muddy Nile. If a Greek, he had no doubt heard the fierce laugh of the hyena in Asia Minor; or fished at Crete for the bee-eater, as the boys do at the present day, with a locust flying from the end of his line; or quarrelled with a friend over the changing hues of the chameleon in Greece or Sicily. If a Roman, he had seen, in the cruel games of the amphitheatre, elephants, lions, and panthers slaughtered for the amusement of the people. Whatever his country may have been, at whatever time he lived, whether an ancient patriarch or a modern farmer, he was perfectly at home among the domestic animals, and had, no doubt, also marked the deer in the forest, the fish in the river, the croaking frog in the swamp, and the busy insect flitting through the air or creeping on the ground. If he were a man of inquiring mind, he would be anxious to learn what forms of animal life other lands had to exhibit, to compare them with those of his own country, and thus to find, little by little, all the links in that wondrous chain which leads from the minute animalcule, of which the point of a needle will crush a thousand, to man himself, the noblest work of the Creator.

The man who thus observed the habits and peculiarities of the animal kingdom, who sought to accumulate information regarding its different members, and who classed them together in accordance with their manifest points of resemblance, would be called a student of Natural History; but he would, at the same time, be a builder up of the science of Zoology. As *ge* in Geology means *the earth*, so the word *zoon* is the Greek for *an animal*, and Zoology is thus *a discourse about animals*. This study, above all others, is that in which young people take especial delight, and it is also one to which have been devoted the life labours of some of the greatest minds that the world has produced.

We have now surveyed three of the Natural Sciences, embracing the mineral, vegetable, and animal kingdoms. You will be ready to say, "Surely we have exhausted the world of Nature; what is there that is not included in those three sciences of Geology, Botany, and Zoology?" Not so fast, dear reader. Have we not an atmosphere around us, invisible it may be, yet in which we live and breathe? Are there no clouds in the heavens, no dew on the grass? Are there no long rainy days and months of ice and snow? Do not the cold March winds chill us with their keen blast, and the summer breezes fan our flushed cheeks with their cool and gentle motion? Then, have we not watched the coming of the fierce tempest, heard the rumbling of the thunder, and seen the vivid lightning flash across the sky? We have seen, too, the beautiful arch of the rainbow by day, and the fiery meteor at night; and, in books, we have read about the great ice mountains of the North, the waterspouts that, uniting the clouds above to the sea beneath, break with fatal violence in the Southern Ocean; with many other strange sights and sounds that take place in the unseen body around us. All these are well worthy, not only of observation, but of diligent and accurate investigation; therefore they have a science to themselves, and that science is called Meteorology.

Meteorology is a Greek word, made up of *meteora*, meaning *things in the air*, and *logos*, a discourse—a *discourse about things in the air*. Learned men, masters of this science, are employed by many governments to observe the state of the atmosphere, and to keep a record of all that occurs in it from year to year; for this purpose, they are furnished with a suitable building, generally situated on a rising ground, and having a tower of some height upon it, whence they may be able to detect the appearance of anything in the air, whether it be watery like snow and rain, airy like wind, or fiery as falling stars. Such a building is called an *observatory*, and is also sometimes used for making astronomical observations; the most celebrated one is that of Greenwich, near London in England.

So far then, we have four sciences brought before us; discourses about plants and animals, about the earth and things in the air. Is there any natural object upon this earth which is not included in the four sciences that treat of these several departments of Nature? No, there is nothing more, but yet there is another science. We examine a piece of rock, the leaf of a tree, the leg of a frog, and a handful of snow, and we put the question—What are all these things made of? Now, this seems a very strange question; if you were asked, you would, perhaps, answer, that the rock was made of some kind of stone, and the leaf of delicate fibres and cells, the frog's leg of flesh and bones, and the snow of frozen water; and you would expect the person who put the question to smile approvingly and say—"Your reply is quite correct." But I very much fear that such an answer would not satisfy a chemist; he would desire to go deeper into the matter, and would, probably, ask you, what stone and fibres, flesh and bones and water are composed of. To say that rock is stone is as much an explanation as to say that a house is a domicile, and that a leaf is made up of fibres and cells, as that a house is made up of rooms. But if you were asked what a house were made of, you would reply, "of brick or stone, and mortar," or "of wood," as the case might be. Now, just such an answer as this is what the chemist requires to his question. He would tell you that the stone, suppose it were limestone, was composed of a certain number of parts of lime and carbonic acid, and so on with the rest. Again, he would inform you that lime is made up of so many atoms or small particles of a metal called calcium, and a gas called oxygen; and carbonic acid, of similar atoms of oxygen, and another substance, denominated carbon. But calcium, oxygen, and carbon cannot be reduced to anything lower; they are the bricks and mortar that make the house, and all that went before them were only the rooms. These three bodies, or substances, are named *elements* or *elementary substances*, because they are not composed of anything more simple. The elementary bodies are about sixty-three in number, and of these sixty-three elements everything in the world is made up, whether it belong to the mineral or vegetable, the animal or the aerial kingdom. It is with these simple bodies that the chemist works, building up or taking to pieces, room by room, and brick by brick, the materials of which the earth and everything in it is composed; and the science which teaches the one and explains the other is called Chemistry.

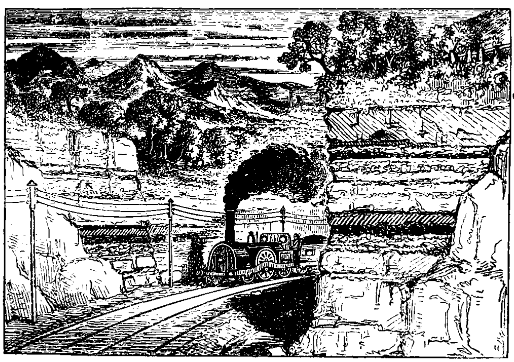
The term Chemistry is very like one of the simple bodies which the science investigates, for its origin is very obscure, and the Greek word *chemeia*, from which it is thought to be derived, has no simpler meaning. However, it is supposed by some that it comes from the Greek *chymicos*, equivalent to what is said *concerning a thing extracted*; so that, with this explanation, chemistry would be *the system of knowledge about things extracted.* Since *to extract* has the meaning of *to draw out,* you will easily perceive that it is applicable to the science which draws forth the simple elements that make up a compound body. Of all the sciences, none is so practically useful as that of chemistry, the laws of which are found to govern most of the simplest as well as the most important operations of man upon natural objects.

We have now found out what are the five natural sciences, under which everything in the world, whether simple or compound, may be ranked. If you would be well-informed men and women, you should gain some knowledge of each of these. To all right-minded persons they will prove an endless source of amusement, as well as of profit, stimulating legitimate curiosity, encouraging habits of observation, and increasing reverence for Him who in wisdom has made all the objects of which they treat.

The Natural Sciences are—

1. Geology.
2. Botany.
3. Zoology.
4. Meteorology.
5. Chemistry.

GEOLOGY.



RAILWAY CUTTING SHOWING STRATA.

Geology, from two Greek words—*ge*, the earth, and *logos*, a discourse or reasoning—embraces, in its widest sense, all that can be known of the constitution and history of our globe Its object is to examine the various materials of which our planet is composed, to describe their appearance and relative positions, to investigate their nature and mode of formation, and generally to discover the laws which seem to regulate their arrangement.

As a department of natural science, Geology confines itself more especially to a consideration of the mineral or rocky constituents of the earth, and leaves its surface configuration to Geography, its vegetable life to Botany, its animal life to Zoology, and the elementary constitution of bodies to the science of Chemistry. Being unable to penetrate beyond a few thousand feet into the solid substance of the globe, the labours of geologists are necessarily confined to its exterior shell or crust; hence we speak of the "crust of the globe," meaning thereby that portion of the rocky structure accessible to human investigation.

The materials composing this crust are rocks or minerals of various kinds—as granite, basalt, roofing-slate, sandstone, marble, coal, chalk, clay, and sand—some hard and compact, others soft and incohering. These substances do not occur indiscriminately in every part of the world, nor, when found, do they always appear in the same position. Granite, for example, may exist in one district of a country, marble in another, coal in a third, and chalk in a fourth. Some of these rocks occur in regular layers or courses, termed *strata*, from the Latin word *stratum*, strewn or spread out, while others rise up in irregular mountain-masses. It is evident that substances differing so widely in composition and structure must have been formed under different circumstances and by different causes; and it becomes the task of the geologist to discover those causes, and thus infer the general conditions of the regions in which, and of the periods when, such rock substances were produced.

When we sink a well, for example, and dig through certain clays, sands, and gravels, and find them succeeding each other in layers, we are instantly reminded of the operations of water, seeing it is only by such agency that accumulations of clay, sand, and gravel are formed at the present day. We are thus led to inquire as to the origin of the materials through which we dig, and to discover whether they were originally deposited in river-courses, in lakes, in estuaries, or along the sea-shore. In our investigation we may also detect shells, bones, and fragments of plants imbedded in the clays and sands; and thus we have a further clue to the history of the strata through which we pass, according as the shells and bones are the remains of animals that lived in fresh-water lakes and rivers, or inhabited the waters of the ocean. Again, in making a railway-cutting, excavating a tunnel, or sinking a coal-pit, we may pass through many successions of strata—such as clay, sandstone, coal, ironstone, limestone, and the like; and each succession of strata may contain the remains or impressions of different plants and animals. Such differences can only be accounted for by supposing each stratum or set of strata to have been formed by different agencies, and under different conditions of climate, as well as under different arrangements of sea and land, just as at the present day the rivers, estuaries, and seas of different countries are characterised by their own special accumulations, and by the imbedded remains of the plants and animals peculiar to these regions.

In making these investigations, the geologist is guided by his knowledge of what is now taking place on the surface of the globe —ascribing similar results to similar or analogous causes. Thus, in the present day, we see rivers carrying down sand and mud and gravel, and depositing them in layers either in lakes, in estuaries, or along the bottom of the ocean. By this process many lakes and estuaries have, within a comparatively recent period, been filled up and converted into dry land. We see also the tides and waves wasting away the sea-cliffs in one district, and accumulating expanses of sand and salt-marsh in some sheltered locality. By this agency thousands of acres of land have been washed away and covered by the sea, even within the memory of man; while, by the same means, new tracts have been formed in districts formerly covered by the tides and waves. Further, we learn that, during earthquake convulsions, large districts of country have sunk beneath the waters of the ocean; while in other regions the sea bottom has been elevated into dry land. Volcanic action is also sensibly affecting the surface of the globe—converting level tracts into mountain-ridges, throwing up new islands from the sea, and casting forth molten lava and other materials, which in time become hard and consolidated rock-masses.

As these and other agents are at present modifying the surface of the globe, and changing the relative positions of sea and land, so in all time past have they exerted a similar influence, and have necessarily been the main agents employed in the formation of the rocky crust which it is the province of Geology to investigate. Not a foot of the land we now inhabit but has been repeatedly under the ocean, and the bed of the ocean has formed as repeatedly the habitable dry land. No matter how far inland, or at what elevation above the sea, we now find accumulations of sand and gravel,—no matter at what depth we now discover strata of sandstone or limestone,—we know, from their composition and arrangement, that they must have been formed under water, and brought together by the operation of water, just as layers of sand and gravel and mud are accumulated or deposited at the present day. And as earthquakes and volcanoes break up, elevate, and derange the present dry land, so must the fractures, derangements, and upheavals among the strata of the rocky crust be ascribed to the operation of similar agents in remote and distant epochs.

By the study of existing operations, we thus get a clue to the history of the globe; and the task is rendered much more certain by an examination of the plants and animals found imbedded in the various strata. At present, shells, fishes, and other animals are buried in the mud or *silt* of lakes and estuaries; rivers also carry down the remains of land-animals, the trunks of trees, and other vegetable drift; and earthquakes submerge plains and islands, with all their vegetable and animal inhabitants. These remains become enveloped in the layers of mud and sand and gravel formed by the waters, and in process of time are *petrified*, (*petra*, a stone, and *fio*, I become;) that is, are converted into stony matter like the shells and bones found in the deepest strata. Now, as at present, so in all former time must the remains of plants and animals have been similarly preserved; and as one tribe of plants is peculiar to the dry plain, and another to the swampy morass,—as one family belongs to a temperate, and another to a tropical region,—so, from the character of the imbedded plants, are we enabled to arrive at some knowledge of the conditions under which they flourished. In the same manner with animals: each tribe has its locality assigned it by peculiarities of food, climate, and the like; and by comparing *fossil* remains (fossil, from *fossus*, dug up, applied to all remains of plants and animals imbedded in the rocky crust) with existing races, we are enabled to determine many of the past conditions of the world with considerable certainty.

By examining, noting, and comparing, as indicated in the preceding paragraphs, the geologist finds that the strata composing the earth's crust can be arranged in series; that one set or series always underlies, and is succeeded by another set; and that each series contains the remains of plants and animals not to be found in any other series. Having ascertained the existence of such a sequence among the rocky strata, his next task is to determine that sequence in point of time—that is, to determine the older from the newer series of strata; to ascertain, if possible, the nature of the plants and animals whose remains are imbedded in each set; and, lastly, to discover the geographical range or extent of the successive series. These series he calls *formations*, as having been formed during different arrangements of sea and land, and under the varying influences of climate and other external conditions; and it is by a knowledge of these that the geologist is enabled to arrive at something like a history of the globe—imperfect, it may be, but still sufficient to show the numerous changes its surface has undergone, and the varied and wonderful races of plants and animals by which it has been successively inhabited. To map out the various mutations of sea and land, from the present moment to the earliest time of which we have any traces in the rocky strata: to restore the forms of extinct plants and animals; to indicate their habits, the climate and conditions under which they grew and lived,—to do all this, and trace their connexion up to existing races, would be the triumph, as it is now the aim, of all true geology.

—PAGE.

Rocks as to their origin are—

1. *Sedimentary or Aqueous*, formed by the agency of water and deposited in regular strata; these rocks are either... *Inorganic*, as Sandstone. *Organic*, as Coal, Shell-marl, &c.
2. *Metamorphic or Changed Rocks;* originally Sedimentary, but become crystallised by the action of heat; such are gneiss, marble, &c.
3. *Eruptive;* never occur in strata but in irregular masses; when appearing on the surface are called *Volcanic;* such are granite, lava, pumice, &c.

FIRST STUDIES OF A YOUNG GEOLOGIST.

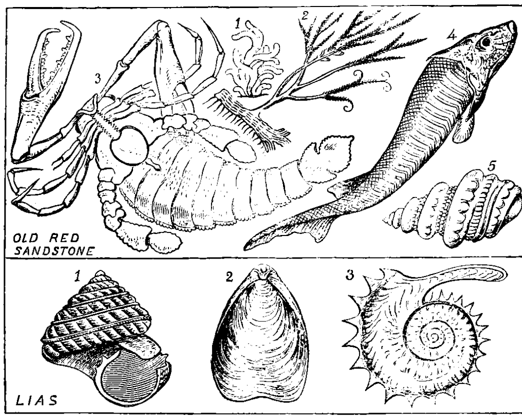
IT was twenty years last February since I set out a little before sunrise to make my first acquaintance with a life of labour and restraint, and I have rarely had a heavier heart than on that morning. I was but a slim loose-jointed boy at the time—fond of the pretty intangibilities of romance, and of dreaming when broad awake; and, woeful change! I was now going to work at what Burns has instanced, in his "Twa Dogs," as one of the most disagreeable of all employments, to work in a quarry. Bating the passing uneasiness occasioned by a few gloomy anticipations, the portion of my life which had already gone by had been happy beyond the common lot. I had been a wanderer among rocks and woods,—a reader of curious books when I could get them,—a gleaner of old traditionary stories; and now I was going to exchange all my day-dreams, and all my amusements, for the kind of life in which men toil every day that they may be enabled to eat, and eat every day that they may be enabled to toil!

The quarry in which I wrought lay on the southern shore of a noble inland bay, or frith rather, with a little clear stream on the one side, and a thick fir wood on the other. It had been opened in the old red sandstone of the district, and was overtopped by a huge bank of diluvial clay, which rose over it in some places to the height of nearly thirty feet, and which at this time was rent and shivered, wherever it presented an open front to the weather, by a recent frost. A heap of loose fragments, which had fallen from above, blocked up the face of the quarry, and my first employment was to clear them away. The friction of the shovel soon blistered my hands, but the pain was by no means very severe, and I wrought hard and willingly that I might see how the huge strata below, which presented so firm and unbroken a frontage, were to be torn up and removed. Picks and wedges and levers were applied by my brother workmen; and simple and rude as I had been accustomed to regard these implements, I found I had much to learn in the way of using them. They all proved inefficient, however, and the workmen had to bore into one of the inferior strata, and employ gunpowder. The process was new to me, and I deemed it a highly amusing one: it had the merit, too, of being attended with some such degree of danger as a boating or rock excursion, and had thus an interest independent of its novelty. We had a few capital shots; the fragments flew in every direction, and an immense mass of the diluvium came toppling down, bearing with it two dead birds, that in a recent storm had crept into one of the deeper fissures, to die in the shelter. I felt a new interest in examining them. The one was a pretty cock goldfinch, with its hood of vermilion, and its wings inlaid with the gold to which it owes its name, as unsoiled and smooth as if it had been preserved for a museum. The other, a somewhat rarer bird, of the woodpecker tribe, was variegated with light blue and a grayish yellow. I was engaged in admiring the poor little things, more disposed to be sentimental, perhaps, than if I had been ten years older, and thinking of the contrast between the warmth and jollity of their green summer haunts, and the cold and darkness of their last retreat, when I heard our employer bidding the workmen lay by their tools. I looked up and saw the sun sinking behind the thick fir wood beside us, and the long, dark shadows of the trees stretching downwards towards the shore.

This was no very formidable beginning of the course of life I had so much dreaded. To be sure, my hands were a little sore, and I felt nearly as much fatigued as if I had been climbing among the rocks; but I had wrought and been useful, and had yet enjoyed the day fully as much as usual. It was no small matter, too, that the evening, converted, by a rare transmutation, into the delicious "blink of rest" which Burns so truthfully describes, was all my own. I was as light of heart next morning as any of my brother-workmen. There had been a smart frost during the night, and the rime lay white on the grass as we passed onwards through the fields; but the sun rose in a clear atmosphere, and the day mellowed as it advanced, into one of those delightful days of early spring, which give so pleasing an earnest of whatever is mild and genial in the better half of the year. All the workmen rested at midday, and I went to enjoy my half-hour alone on a mossy knoll in the neighbouring wood, which commands through the trees a wide prospect of the bay and the opposite shore. There was not a wrinkle on the water, not a cloud in the sky, and the branches were as motionless in the calm as if they had been traced on canvas. From a wooded promontory that stretched half-way across the frith, there ascended a thin column of smoke. It rose straight as the line of a plummet for more than a thousand yards, and then, on reaching a thinner stratum of air, spread out equally on every side, like the foliage of a stately tree. Ben Wyvis rose to the west, white with the yet unwasted snows of winter, and as sharply defined in the clear atmosphere, as if all its sunny slopes and blue retiring hollows had been chiselled in marble. A line of snow ran along the opposite hills; all above was white, and all below was purple. They reminded one of the pretty French story, in which an old artist is described as tasking the ingenuity of his future son-in-law, by giving him, as a subject for his pencil, a flower-piece composed of only white flowers, of which the one half were to bear their proper colour, the other half a deep purple hue, and yet all be perfectly natural; and how the young man resolved the riddle, and gained his mistress, by introducing a transparent purple vase into the picture, and making the light pass through it on the flowers that were drooping over the edge. I returned to the quarry, convinced that a very exquisite pleasure may be a very cheap one, and that the busiest employments may afford leisure enough to enjoy it.

The gunpowder had loosened a large mass in one of the inferior strata, and our first employment, on resuming our labours, was to raise it from its bed. I assisted the other workmen in placing it on edge, and was much struck by the appearance of the platform on which it rested. The entire surface was ridged and furrowed like a bank of sand that had been left by the tide an hour before. I could trace every bend and curvature, every cross hollow and counter ridge of the corresponding phenomena; for the resemblance was no half resemblance—it was the thing itself; and I had observed it a hundred and a hundred times, when sailing my little schooner in the shallows left by the ebb. But what had become of the waves that had thus fretted the solid rock, or of what element had they been composed? I felt as completely at fault as Robinson Crusoe did on discovering the print of the man's foot on the sand. The evening furnished me with still further cause of wonder. We raised another block in a different part of the quarry, and found that the area of a circular depression in the stratum below was broken and flawed in every direction, as if it had been the bottom of a pool recently dried up, which had shrunk and split in the hardening. Several large stones came rolling down from the diluvium in the course of the afternoon. They were of different qualities from the sandstone below, and from one another; and, what was more wonderful still, they were all rounded and water-worn, as if they had been tossed about in the sea, or on the bed of a river for hundreds of years. There could not, surely, be a more conclusive proof that the bank which had enclosed them so long could not have been created on the rock on which it rested. No workman ever manufactures a half-worn article, and the stones were all half-worn! And if not the bank, why then the sandstone underneath? I was lost in conjecture, and found I had food enough for thought that evening, without once thinking of the unhappiness of a life of labour.

The immense masses of diluvium which we had to clear away rendered the working of the quarry laborious and expensive, and all the party quitted it in a few days, to make trial of another that seemed to promise better. The one we left is situated, as I have said, on the southern shore of an inland bay—the Bay of Cromarty; the one to which we removed has been opened in a lofty wall of cliffs that overhangs the northern shore of the Moray Frith. I soon found I was to be no loser by the change. Not the united labours of a thousand men for more than a thousand years could have furnished a better section of the geology of the district than this range of cliffs. It may be regarded as a sort of chance dissection on the earth's crust. We see in one place the primary rock, with its veins of quartz and granite, its dizzy precipices of gneiss, and its huge masses of hornblende; we find the secondary rock in another, with its beds of sandstone and shale, its spars, its clays, and its nodular limestones. We discover the still little known but highly interesting fossils of the Old Red Sandstone in one deposi-



tion; we find the beautifully preserved shells and lignites of the Lias in another. There are the remains of two several creations at once before us. The shore, too, is heaped with rolled fragments of almost every variety of rock,—basalts, ironstones, hypersthenes, porphyries, bituminous shales, and micaceous schists. In short, the young geologist, had he all Europe before him, could hardly choose for himself a better field. I had, however, no one to tell me so at the time, for geology had not yet travelled so far north; and so, without guide or vocabulary, I had to grope my way as I best might, and find out all its wonders for myself. But so slow was the process, and so much was I a seeker in the dark, that the facts contained in these few sentences were the patient gatherings of years.

—Hugh Miller.

Rocks as to age and order of succession are classified as—

Epoch of Modern Life.	1. Modern deposits,	changes now going on.
	2. Drift formation,	to this belong the scattered boulders.
	3. Tertiary system,	recent fossil remains.

Epoch of Middle Life.	1. Cretaceous system,	from the Latin *creta*, chalk, which accompanies it in Europe.
	2. Oolitic ,,	from two Greek words meaning *egg* and *stone*, because composed of limestone consisting of egg-shaped grains.
	3. Triassic ,,	so called from the number *three*, because in Europe it consists of three strata—marl, limestone and sandstone.
Epoch of Ancient Life.	1. Permian system,	from Perm in Russia; in England it is called New Red Sandstone.
	2. Carboniferous ,,	or *coal-bearing;* to this belong the coal-fields.
	3. Devonian ,,	from Devonshire in England; also called Old Red Sandstone.
	4. Silurian ,,	from the ancient kingdom of the Silures in Britain, where it was first observed.
Epoch of Doubtful Life.	Metamorphic System,	from the Greek words meaning "changed form."
	This system is sometimes divided into two formations, called the	Huronian, from Lake Huron, and Laurentian, from the river St Lawrence, near which they are found.

Eruptive rocks being of all ages have no order of succession.

MINERALOGY.

Natural History is a science which consists of many branches; one, which treats of animals, is called Zoology; another, Botany, teaches the structure and properties of plants; the third, which makes us acquainted with the inorganic portions of our planet, namely, stones or minerals, is called Mineralogy; and if, at first sight, it should appear less attractive or less useful than the other two branches, a very little consideration will prove that it is of equal importance to mankind, and contributes materially to their comfort, wealth, and luxury. From materials found in the interior of the earth we erect our dwellings, we supply ourselves with fuel, we construct numberless tools and machines; and, finally, we obtain our most brilliant ornaments.

Some knowledge of many of these substances must have been possessed at a very remote period. The most ancient nations of whom we have any record manufactured arms, and ornaments of gold and silver. The Romans, who made great improvements in the arts of civilisation, greatly enlarged this knowledge; bringing to light many substances previously unknown, and employing them for useful or ornamental purposes; they were acquainted with several of the precious stones, and, with the exception of the diamond, succeeded in cutting and engraving on them.

The elder Pliny, a man of inquiring mind and unwearied diligence in the pursuit of knowledge, collected, from every source within his reach, accounts of all the natural productions that were then known, or of which any description existed in his time; and he added to these his own observation on such as he had actually examined. It is much to be regretted that the latter were not more numerous; for he too often copied, without inquiry, the descriptions he met with; and has transmitted to us a vast number of inaccuracies and absurdities, such as accounts of the magical properties of certain stones, plants, and animals, and charms, by which particular diseases might be cured.

As civilisation extended, and the arts of life advanced, a greater number of useful minerals became known; improvements in machinery and practical science led to greater facility in the working of mines, metals were more sought after, new ones were discovered, and new and rich ores of those already known were found to exist, which had formerly been thrown aside as valueless, from ignorance of their nature. Mineralogy now became a subject of importance, and much attention was paid to it; but it still retained somewhat of a vague and unsatisfactory character, from want of knowledge of the principles on which it ought to be based. Chemistry, indeed, lent its aid in the analysis of minerals; but it was before chemistry itself had been raised to the state of an exact science by the wonderful and beautiful law of *definite proportions*, a law which pervades all chemical combinations, whether natural compounds or the result of operations in our laboratories. This law assists us in ascertaining with precision the composition of mineral substances, and consequently in identifying mineral species, and giving them their true place in a scientific classification.

The want of some knowledge of the real nature of stones, which even a slight acquaintance with mineralogy would furnish, has occasioned to many persons, within a comparatively recent period, very ruinous loss; whilst others have rapidly acquired a fortune from profiting, under similar circumstances, by opportunities that had been unseen or totally neglected. It is not above fifty years since a man found in Shropshire a considerable vein of sulphate of baryta, which, in consequence of its weight, he mistook for white lead ore, and he erected a smelting-house and furnaces for the purpose of reducing it to a metallic state. Another person in the same county, having met with some mica in the form of small silvery scales or spangles, was persuaded that he had found a silver mine, and ruined himself in attempts to obtain the silver.

Among many other unfortunate adventures which have arisen from ignorance of mineralogy, may be mentioned that of a poor man, who was persuaded to lay out a hundred pounds, nearly the whole of some years' economy, in the purchase of a few pieces of white topaz, under the idea that they were diamonds. But independently of the utility of this science, any one who studies natural history for his amusement, will be richly rewarded by the wonders and the beauties displayed in the mineral kingdom. The bodies which are the objects of study to the mineralogist, comprise the earthy, metallic, saline, and other substances which compose our earth—that is to say, the unorganised part of the creation.

To understand clearly what is meant by the term *unorganised*, let us remember that an animal and a plant are said to be *organised*, because they consist of several different parts, all varying in their form, their position, and their functions, yet all equally necessary to form a perfect animal, or a perfect plant; so that to remove any one of them would be to destroy, or at least to render imperfect, the body to which it belongs. These parts are called *organs;* in animals we find a *stomach* to digest the food they convey to it, and by means of which they are nourished and have life; *nerves* and *muscles* for sensation and motion; in plants we observe a root to fix them to the ground, and absorb nourishment from it, and *vessels* for the circulation of the *sap*.

But in a mineral, in its most perfect state, all the parts exactly resemble each other, so that, by breaking it, we diminish it in size without destroying its existence or its completeness. Take, for example, a flat pebble, or a fragment of limestone from a quarry, and break it; we shall find that each substance is of the same texture and composition throughout. It is true that we may also take up a stone, or break off a piece of rock, which has not this homogeneous structure, as, for instance, a granite paving stone; but granite is an aggregate rock, which consists essentially of three simple minerals, each of which may plainly be distinguished on inspection; and mineralogy teaches us to recognise in it,—1st, quartz, which usually appears in grayish semi-transparent grains, of a somewhat glassy appearance; 2d, felspar, of a reddish or yellowish white, and opaque; 3d, mica, in small scales, which have a shining and somewhat metallic lustre.

It is true that the essential difference of minerals consists in their composition; but it is not therefore necessary to subject every mineral to chemical analysis in order to know something of its nature. The difference of composition is manifested in difference of form, structure, colour, weight, hardness, transparency, &c.; and an acquaintance with these and some other properties or characters will, in most cases, enable us to recognise a mineral species, and to know of what elementary substances it principally consists. These are called *physical characters.* But it sometimes happens that we meet with a specimen in which these characters are not clearly marked, or some of them may have a great resemblance to those of another species; in such cases we may derive great assistance from an examination of some of the *chemical characters,* by means of acids and the action of the blowpipe, which have a very different effect on different species.

—WEALE.

Dana's Classification of Minerals—

Class I.	Gases; consisting of, or containing nitrogen or hydrogen, air, &c.
Class II.	Water; crystallises as ice.
Class III.	Carbon and compounds of carbon; the diamond, coal, plumbago, amber, &c.
Class IV.	Sulphur and its acids.
Class V.	Haloid or salt-like minerals; salt, nitre, borax, alum, gypsum, &c.
Class VI.	Earthy minerals; quartz, opal, felspar, mica, ruby, emerald, &c.
Class VII.	Metals and metallic ores; gold, silver, mercury, iron, lead, copper, &c.

TUBAL CAIN.

OLD Tubal Cain was a man of might,
  In the days when earth was young;
By the fierce red light of his furnace bright,
  The strokes of his hammer rung:
And he lifted high his brawny hand
  On the iron glowing clear,
Till the sparks rush'd out in scarlet showers,
  As he fashion'd the sword and spear.

And he sang,—"Hurrah for my handiwork!
  Hurrah for the spear and sword!
Hurrah for the hand that shall wield them well,
  For he shall be king and lord!"

To Tubal Cain came many a one,
  As he wrought by his roaring fire,
And each one pray'd for a strong steel blade,
  As the crown of his desire:
And he made them weapons sharp and strong,
  Till they shouted loud for glee;
And they gave him gifts of pearls and gold,
  And spoils of the forest free.
And they sang,—"Hurrah for Tubal Cain,
  Who hath given us strength anew!
Hurrah for the smith, hurrah for the fire,
  And hurrah for the metal true!"

But a sudden change came o'er his heart,
  Ere the setting of the sun;
And Tubal Cain was fill'd with pain
  For the evil he had done:
He saw that men, with rage and hate,
  Made war upon their kind,
That the land was red with the blood they shed,
  In their lust for carnage blind.
And he said, "Alas! that I ever made,
  Or that skill of mine should plan,
The spear and the sword, for men whose joy
  Is to slay their fellow-man!"

And for many a day old Tubal Cain
  Sat brooding o'er his woe;
And his hand forbore to smite the ore,
  And his furnace smoulder'd low.
But he rose at last with a cheerful face,
  And a bright courageous eye,
And bared his strong right arm for work,
  While the quick flames mounted high.
And he sang,—"Hurrah for my handiwork!"
  And the red sparks lit the air;
"Not alone for the blade was the bright steel made,"
  And he fashion'd the first ploughshare.

And men, taught wisdom from the past,
  In friendship join'd their hands;
Hung the sword in the hall, the spear on the wall,
  And plough'd the willing lands:
And sang,—"Hurrah for Tubal Cain!
  Our staunch good friend is he;
And for the ploughshare and the plough,
  To him our praise shall be.
But while oppression lifts its head,
  Or a tyrant would be lord;
Though we may thank him for the plough,
  We'll not forget the sword!"

—CHARLES MACKAY.

COPPER MINES OF LAKE SUPERIOR.

To untutored man, provided only with implements of stone, the facilities presented by the great copper regions of Lake Superior, for the first step in the knowledge of metallurgy, were peculiarly available. The forests that flung their shadows along the shores of that great lake were the haunts of the deer, the beaver, the bear, and other favourite objects of the chase; the rivers and the lake abounded with fish; and the rude hunter had to manufacture weapons and implements out of such materials as nature placed within his reach. The water-worn stone from the beach, patiently ground to an edge, made his axe and tomahawk; by means of which, with the help of fire, he could level the giants of the forest, or detach from them the materials for his canoe and paddle, his lance, club, or bow and arrows. The bones of the deer pointed his spear, or were wrought into fish-hooks; and the shale or flint was chipped and ground into his arrow-head, after a pattern repeated with little variation, in all countries, and in every primitive age. But besides such materials of universal occurrence, the primeval occupant of the shores of Lake Superior found there a *stone* possessed of some very peculiar virtues. It could not only be wrought to an edge without liability to fracture, but it was malleable, and could be hammered out into many new and convenient shapes. This was the copper, found in connexion with the trappean rocks of that region, in inexhaustible quantities, in a pure metallic state. In other rich mineral regions, as in those of Cornwall and Devon, the principal source of this metal is from ores, which require both labour and skill to fit them for economic purposes. But in the veins of the copper-region of Lake Superior the native metal occurs in enormous masses, weighing hundreds of tons; and loose blocks of various sizes have been found on the lake shore, or lying detached on the surface, in sufficient quantities to supply all the wants of the nomad hunter. These, accordingly, he wrought into chisels and axes, armlets, and personal ornaments of various kinds, without the use of the crucible; and, indeed, without recognising any precise distinction between the copper which he mechanically separated from the mass, and the unmalleable stone or flint out of which he had been accustomed to fashion his spear and arrow-heads.

It was in the year 1847 that attention was first directed to such traces of ancient mining operations by the agent of the Minnesota Mining Company. Following up the indications of a continuous depression in the soil, he came at length to a cavern where he found several porcupines had fixed their quarters for hybernation: but detecting evidences of artificial excavation, he proceeded to clear out the accumulated soil, and not only exposed to view a vein of copper, but found in the rubbish numerous stone mauls and hammers of the ancient workmen. Subsequent observation brought to light ancient excavations of great extent, frequently from twenty-five to thirty feet deep, and scattered over an area of several miles. The rubbish taken from these is piled up in mounds alongside, while the trenches have been gradually refilled with the soil and decaying vegetable matter gathered through the long centuries since their desertion; and over all the giants of the forest have grown, withered, and fallen to decay.

Whatever be the dates of their commencement or desertion, the condition in which some of the ancient works on Lake Superior have been found, when reopened in later times, is suggestive of peculiar circumstances attending their abandonment. It is inconceivable that the huge mass of copper discovered in the Minnesota mine, resting on its oaken cradle, beneath the accumulations of centuries, was abandoned merely because the workmen, who had overcome the greatest difficulties in its removal, were baffled in the subsequent stages of their operations, and contented themselves by chipping off any accessible projecting point. Well-hammered copper chisels, such as lay alongside of it, and have been repeatedly found in the works, were abundantly sufficient, with the help of stone hammers, to enable them to cut it into portable pieces. If, indeed, the ancient miners were incapable of doing more with their mass of copper in the mine than breaking off a few projections, to what further use could they have turned it when transported to the surface? It weighed upwards of six tons, and measured ten feet long and three feet wide. The trench, at its greatest depth, was twenty-six feet; while the mass was only eighteen feet from the surface; and in the estimation of the skilled engineer by whom it was first seen, it had been elevated upwards of five feet since it was placed on its oaken frame. The excavations to a depth of twenty-six feet, the dislodged copper block, and the framework prepared for elevating the solid mass to the surface, all consistently point to the same workmen. But the mere detachment of a few accessible projecting fragments is too lame and impotent a conclusion of proceedings carried thus far on so different a scale. It indicates rather such results as would follow at the present day, were the barbarian tribes of the North-west to displace the present Minnesota miners, and possess themselves of mineral treasures they are as little capable as ever of turning to any but the most simple uses.

Such evidences, accordingly, while they serve to prove the existence, at some remote period, of a mining population in the copper regions of Lake Superior, seem also to indicate that their labours had come to an abrupt termination. Whether by some terrible devastating pestilence, like that which nearly exterminated the native population of New England immediately before the landing of the Pilgrim Fathers, or by the breaking out of war, or, as seems not less probable, by the invasion of the mineral region by a barbarian race, ignorant of all the arts of the ancient mound-builders of the Mississippi, and of the miners of Lake Superior: certain it is that the works have been abandoned, leaving the quarried metal, the laboriously wrought hammers, and the ingenious copper tools, just as they may have been left when the shadows of the evening told their long-forgotten owners that the labours of the day were at an end, but for which they never returned. Nor during the centuries which have elapsed since the forest reclaimed the deserted trenches for its own, does any trace seem to indicate that a native population again sought to avail itself of their mineral treasures, beyond the manufacture of such scattered fragments as lay upon the surface.

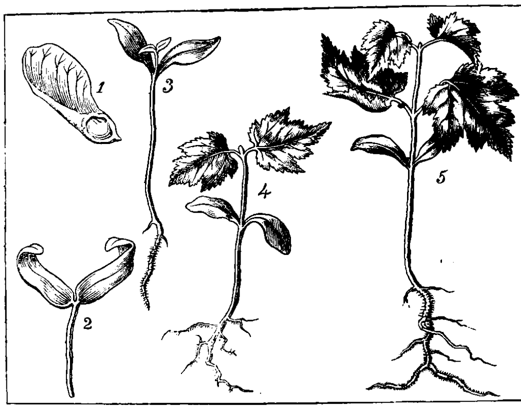
—Dr D. Wilson's *Prehistoric Man.*

BOTANY.

We see plants growing from the seed in spring-time, and gradually developing their parts: at length they blossom, bear fruit, and produce seeds like those from which they grew. Shall we commence the study of the plant with the full-grown herb or tree, adorned with flowers or laden with fruit? Or shall we commence with the seedling just rising from the ground? On the whole, we may get a clearer idea of the whole life and structure of plants if we begin at the beginning,—that is, with the plantlet springing from the seed, and follow it throughout its course of growth. This also agrees best with the season in which the study of botany is generally commenced,—namely, in the spring of the year, when the growth of plants from the seed can hardly fail to attract attention. Indeed, it is this springing forth of vegetation from seeds and buds, after the rigours of our long winter, clothing the earth's surface almost at once with a mantle of freshest verdure, which gives to spring its greatest charm. Even the dullest beholder, the least observant of nature at other seasons, can then hardly fail to ask, What are plants? How do they live and grow? What do they live upon? What is the object and use of vegetation in general, and of its particular and wonderfully various forms?

A reflecting as well as observing person, noticing the resemblances between one plant and another, might go on to inquire whether plants, with all their manifold diversities of form and appearance, are not all constructed on one and the same general plan. It will become apparent, as we proceed, that this is the case; that one common plan may be discerned, which each particular plant, whether herb, shrub, or tree, has followed much more closely than would at first view be supposed. The differences, wide as they are, are merely incidental. What is true in a general way of any ordinary vegetable will be found true of all, only with great variation in the details. In the same language, though in varied phrase, the hundred thousand kinds of plants repeat the same story,—are the living witnesses and illustrations of one and the same plan of Creative Wisdom in the vegetable world. So that the study of any one plant, traced from the seed it springs from round to the seeds it produces, would illustrate the whole subject of vegetable life and growth. It matters little, therefore, what particular plant we begin with.

Take, for example, a seedling maple. Sugar maples may be



THE MAPLE.

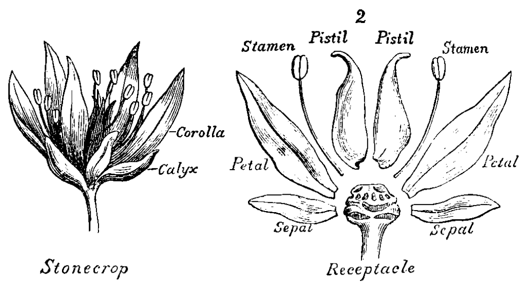
found in abundance in many places, starting from the seed or germinating in early spring, and red maples at the beginning of summer, shortly after the fruits of the season have ripened and fallen to the ground. A pair of narrow green leaves raised on a tiny stem make up the whole plant at its first appearance. Soon a root appears at the lower end of the stemlet; then a little bud at its upper end, between the pair of leaves, which soon grows into a second joint or stem bearing another pair of leaves, resembling the ordinary leaves of the red maple, which the first did not.

Was this plantlet formed in the seed at the time of germination, something as the chick is formed in the egg during the process of incubation? Or did it exist before in the seed, ready formed? To decide this question, we have only to inspect a sound seed, which in this instance requires no microscope, nor any other instrument than a sharp knife, by which the coats of the seed (previously soaked in water, if dry) may be laid open. We find within the seed, in this case, the little plantlet ready formed, and nothing else; namely, a pair of leaves like those of the earliest seedlings, only smaller, borne on a stemlet just like that of the seedling, only much shorter, and all snugly coiled up within the protecting seed-coat. The plant then exists beforehand in the seed in miniature. It was not formed, but only developed in germination; when it had merely to unfold and grow,—to elongate its rudimentary stem, which takes at the same time an upright position, so as to bring the leaf-bearing end into the light and air, where the two leaves expand; while from the opposite end, now pushed farther downwards into the soil, the root begins to grow. All this is true in the main of all plants that spring from real seeds, although with great diversity in the particulars. At least, there is hardly an exception to the fact, that the plantlet exists ready formed in the seed in some shape or other.

The rudimentary plantlet contained in the seed is called an *embryo.* Its little stem is named the *radicle,* because it was supposed to be the root, when the difference between the root and stem was not so well known as now. It were better to name it the *caulicle,* (little stem;) but it is not expedient to change old names. The seed-leaves it bears on its summit (here two in number) are technically called *cotyledons.* The little bud of undeveloped leaves which is to be found between the cotyledons before germination in many cases (as in the pea, bean, &c.) has been named the *plumule.*

In the maple, as also in the morning glory and the like, this bud or plumule is not seen for some days after the seed-leaves are expanded. But soon it appears in the maple as a pair of minute leaves, ere long raised in a stalk which carries them up to some distance above the cotyledons. The plantlet now consists, above ground, of two pairs of leaves—viz., 1. The cotyledons or seed-leaves, borne on the summit of the original stemlet, (the radicle); and 2. A pair of ordinary leaves, raised on a second joint of stem which has grown from the top of the first. Later, a third pair of leaves is formed, and raised on a third joint of stem, proceeding from the summit of the second, just as that did from the first, and so on, until the germinating plantlet becomes a tree.

So the youngest seedling, and even the embryo in the seed, is already an epitome of the herb or tree. It has a stem, from the lower end of which it strikes root; and it has leaves. The tree itself in its whole vegetation has nothing more in kind. To become a tree, the plantlet has only to repeat itself upwardly by producing more similar parts,—that is, new portions of stem, with new and larger leaves, in succession,—while beneath, it pushes its root deeper and deeper into the soil.



THE FLOWER.

The Flower.—The object of the flower is the production of seed. The flower consists of all those parts or *organs* which are subservient to this end. Some of these parts are necessary to the production of seed. Others serve merely to protect or support the more essential parts. The organs of the flower are, therefore, of two kinds; namely, first, the *protecting organs*, or *leaves of the flower*,—also called the *floral envelopes*,—and, second, the *essential organs*. The latter are situated within or a little above the former, and are enclosed by them in the bud. The floral envelopes in a complete flower are double; that is, they consist of two whorls, or circles of leaves, one above or within the other. The outer set forms the *calyx;* this more commonly consists of green or greenish leaves, but not always. The inner set, usually of a delicate texture, and of some other colour than green, aud in most cases forming the most showy part of the blossom, is the *corolla*. Each leaf or separate piece of the corolla is called a *petal;* each leaf of the calyx is called a *sepal*. The sepals and the petals—or, in other words, the leaves of the blossom—serve to protect, support, or nourish the parts within. They do not themselves make a perfect flower.

Some plants, however, naturally produce, besides their perfect flowers, others which consist only of calyx and corolla, (one or both,)—that is, of leaves. These, destitute as they are of the essential organs, and incapable of producing seed, are called neutral flowers. We have an example in the flowers round the margin of the cyme of the hydrangea, and of the cranberry-tree, or snowball, in their wild state. By long cultivation in gardens, the whole cluster has been changed into showy, but useless, neutral flowers, in these and some other cases. What are called *double flowers*, such as full roses, buttercups, and camellias, are blossoms which, under the gardener's care, have developed with all their essential organs changed into petals. But such flowers are always in an unnatural or monstrous condition, and are incapable of maturing seed for want of the *essential organs.*

The essential organs are likewise of two kinds, placed one above or within the other,—namely, first, the *stamens*, or fertilising organs; and, second, the *pistils*, which are to be fertilised and bear the seeds. Taking them in succession, therefore, beginning from below, or at the outside, we have, first, the *calyx*, or outer circle of leaves, which are individually termed *sepals;* secondly, the *corolla*, or inner circle of delicate leaves called *petals;* then a set of *stamens;* and in the centre, one or more *pistils.* The end of the flower-stalk, or the short axis, upon which all these parts stand, is called the *torus*, or *receptacle.*

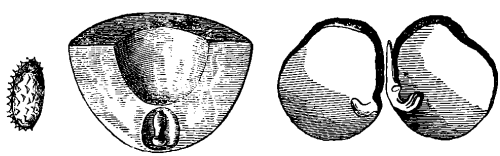
A stamen consists of two parts,—namely, the *filament*, or stalk, and the *anther.* The latter is the only essential part. It is a case, commonly with two lobes or cells, each opening lengthwise by a slit, at the proper time, and discharging a powder or dust-like substance, usually of a yellow colour. This powder is the *pollen*, or fertilising matter, to produce which is the sole office of the stamen.

A pistil is distinguished into three parts; namely,—beginning from below,—the *ovary*, the *style*, and the *stigma.* The *ovary* is the hollow case or young pod, containing rudimentary seeds called *ovules.* The *style* is the tapering part above, sometimes long and slender, sometimes short, and not rarely altogether wanting, for it is not an essential part, like the two others. The *stigma* is the tip or some other portion of the style, (or of the top of the ovary when there is no distinct style,) consisting of loose tissue, not covered, like the rest of the plant, by a skin or epidermis. It is upon the stigma that the pollen falls; and the result is, that the ovules contained in the ovary are fertilised and become *seeds*, by having an embryo formed in them. To the pistil, therefore, all the other organs of the blossom are in some way or other subservient: the stamens furnish pollen to fertilise its ovules; the corolla and the calyx form coverings which protect the whole.

These are all the parts which belong to any flower. But these parts appear under a variety of forms and combinations, some of them greatly disguising their natural appearance. To understand the flower, therefore, under whatever guise it may assume, we must study its plan. —GRAY.

GENERAL DIVISION OF PLANTS.

A PLANT consists of certain parts which are called *organs.* The root, stem, and leaves are concerned in the nourishment of the plant, and are called *nutritive* organs; while the flowers are connected with the production of seeds, and are denominated *reproductive* organs. Some plants produce flowers and seeds, and are called *flowering* or *phanerogamous*, (Greek, visible reproduction;) while others do not produce flowers, but have peculiar organs which give origin to germs, equivalent to seeds, and they are hence called *flowerless* or *cryptogamous*, (Greek, hidden reproduction.) To the former division belong our ordinary trees, shrubs, and herbaceous flowering plants; to the latter belong ferns, mosses, lichens, sea-weeds, and mushrooms.



In flowering plants the seed contains the young or embryo plant, either alone, as in the bean, pea, and wall-flower, or associated with a separate store of nourishment, as in the cocoa-nut, the cereal grasses, and the pansy. When the skin of a bean or pea is removed, the young plant is found within, consisting of the rudimentary root and stem, with two large lobes called *cotyledons;* these cotyledons in the pea are thick and fleshy, and constitute the great bulk of the seed. In the case of the cocoa-nut, the seed, which is contained within the hard shell, consists principally of a mass of nourishing matter, (the white part used for food), in a cavity of which, at the end where the hole in the shell exists, the little embryo plant lies. The embryo is a small and somewhat club-shaped body; its parts are the rudimentary root, and the stem with a single cotyledon, which is wrapped round it.

In flowerless plants, in place of seeds little germs are formed, called *spores*, (Gr. seed,) which do not exhibit any separate parts, and have no cotyledons. Thus all the plants in the world are divided into three great classes, founded on the nature of their embryo—viz., 1, *Dicotyledonous* plants, having two cotyledons, or seed-lobes, or seed-leaves; 2, *Monocotyledonous* plants, in which there is one cotyledon; and, 3, *Acotyledonous* plants, in which there is no cotyledon. The first two divisions embrace flowering or phanerogamous plants, the last flowerless or cryptogamous. Here we see a natural division of the vegetable productions of the globe, and we observe to some extent the plan on which they were formed by the Creator.

—Balfour.

THE FERN AND THE MOSS.

There was a fern on the mountain, and moss on the moor;
And the ferns were the rich, and the mosses the poor.
And the glad breeze blew gayly; from heaven it came,
And the fragrance it shed over each was the same;
And the warm sun shone brightly, and gilded the fern,
And smiled on the lowly-born moss in its turn;
And the cool dews of night on the mountain fern fell,
And they glisten'd upon the green mosses as well.
And the fern loved the mountain, the moss loved the moor,
For the ferns were the rich, and the mosses the poor.

But the keen blast blew bleakly, the sun waxed high,
And the ferns they were broken, and wither'd and dry;
And the moss on the moorland grew faded and pale;
And the fern and the moss shrank alike from the gale.
So the fern on the mountain, the moss on the moor,
Were wither'd and black where they flourish'd before.

Then the fern and the moss, they grew wiser in grief,
And each turned to the other for rest and relief;
And they plann'd that wherever the fern-roots should grow,
There surely the moss should be sparkling below.

And the keen blasts blew bleakly, the sun waxed fierce;
But no wind and no sun to their cool roots could pierce;
For the fern threw her shadow the green moss upon,
Where the dew ever sparkled undried by the sun;
When the graceful fern trembled before the keen blast,
The moss guarded her roots till the storm-wind had pass'd;
So no longer the wind parch'd the roots of the one,
And the other was safe from the rays of the sun.

And thus, and for ever, where'er the ferns grow,
There surely the mosses lie sparkling below;
And thus they both flourish, where naught grew before,
And they both deck the woodland and mountain and moor.

—ELIZA COOK.

A DISH OF VEGETABLES.

FROM the moss to the palm-tree the number of contributions made by the vegetable world towards the sustenance of man would make a bulky list of benefactors. We have not room to advert to them all, still less to talk about them all. It may be well, however, and only grateful in us, as human beings and recipients of vegetable bounty, to do a little trumpeting in honour of the great families of plants which have contributed with more especial liberality towards the colonisation of the world by man.

For example, there is, in the first place, the POTATO family, famous for its liberal principles, and the wide sphere over which its influence is spread. The members of this family, with equal generosity, are prompt to place a luxury upon the rich man's gravy, or a heap of food beside the poor man's salt. The potato family has been for many years one of the noblest benefactors to the human colony; and when it was prevented lately, by ill-health, from the fulfilment of its good intentions, great was the anxiety of men, and many were the bulletins of health sought for and issued.

The family seat of the potatoes is well known to be in America. They are a comparatively new race in our own country, (England,) since they did not come over until some time after the Conqueror. The genealogists have nearly settled, after much discussion, that all members of this family spread over the world, are descended from the potatoes of Chili. Their town-seat is in the neighbourhood of Valparaiso, upon hills facing the sea. The potatoes were early spread over many portions of America, on missions for the benefit of man, who had not been long in discovering that they were friends worth cultivating properly. It is said that the first potato who visited Europe came over with Sir Francis Drake in 1573; it is said, also, that some of the family had accompanied Sir John Hawkins in 1563; it is certain that a body of potatoes quitted Virginia in 1586, and came to England with Sir Walter Raleigh. M. Duval, who has written an elaborate history of the potato family, shows it to be extremely probable that, before the time of Raleigh, a settlement of potatoes had been found in Spain. Reaching England in 1586, the benevolent potato family was welcomed into Belgium in 1590. In 1610, the first potatoes went to Ireland, where they eventually multiplied and grew to form one of the most important branches of this worthy race. The Scotch potatoes date their origin, as a distinct branch, from 1728. It was at dates not very different from this that other branches of the family settled in Germany. The potatoes of Switzerland first settled in 1730, in the Canton of Berne. In 1738, the thriving family extended its benevolent assistance to the Prussians; but it was not until 1767 that its aid was solicited in Tuscany. In France, the kindly efforts of this family were not appreciated until in the middle of the last century, there arose a man, Parmentier, who backed the introduction of potatoes into France with recommendations so emphatic, that it was designed to impute to him the interest of near relationship, not indeed by calling him potato, but by calling potatoes by his name, Parmentiers. The benevolent exertions made by the potato family on behalf of France, during the famine of 1793, completely established it in favour with the grateful people.

Potatoes, though so widely spread, are unable to maintain their health under too warm a climate. On the Andes, they fix their abode at a height of ten to thirteen thousand feet; in the Swiss Alps, they are comfortable on the mountain sides, and spread in Berne to the height of five thousand feet, or not very much less. Over the north of Europe the potato family extends its labours further on into the cold than even barley, which is famous as the hardiest of grain. There are potatoes settled in Iceland, though that is a place in which barley declines to live. The potato is so nutritious, and can be cultivated with so little skill and labour, that it tempts some nations to depend solely on it for sustenance. The recent blight, especially in Ireland, consequently occasioned the most disastrous effects.

The BARLEY branch of the grass family has, however, a large establishment in Scotland, even to the extreme north, in the Orkneys, Shetland, and, in fact, even in the Faroe Islands. They who are in the secrets of the barleys, hint that they would be very glad to settle in the southern districts of Iceland—say about Reikiavik—if it were not for the annoyance of unseasonable rains. In Western Lapland there may be found heads of the house of barley as far north as Cape North, which is the most northern point of the continent of Europe. It has a settlement in Russia, on the shores of the White Sea, beyond Archangel. Over a great mass of Northern Siberia no barley will undertake to live; and as the potatoes have found their way into such barren districts only here and there, the country that is too far north for barley, is too far north for agriculture. There the people live a nomad life, and owe obligation in the world of plants, to lichens for their food, or to such families as offer them the contribution of roots, bark, or a few scraps of fruit.

It is not much that barley asks as a condition of its gifts to any member of the human colony. It wants a summer heat, averaging about forty-six degrees; and it does not want to be perpetually moistened. If it is to do anything at all in moist places, like islands, it must have three degrees added to the average allowance of summer heat, with which it would otherwise be content. As for your broiling hot weather, no barley will stand it. Other grasses may tolerate the tropics if they please; barley refuses to be baked while it is growing. The barleys are known to be settled as an old native family in Tartary and Sicily, two places very far apart. Their pedigree, however, and, indeed, the pedigrees of all the branches of the great grass family must remain a subject wrapped in uncertainty, buried in darkness, and lost in a great fog of conjecture.

We find OATS spread over Scotland to the extreme north point, and settled in Norway and Sweden to the latitudes sixty-three and sixty-five. Both oats and rye extend in Russia to about the same latitude of sixty-three degrees. The benevolent exertion of oats is put forth on behalf not only of men, but also of their horses. In

Scotland and Lancashire, in some countries of Germany, especially south of Westphalia, the people look to oats for sustenance. Scotch bone and muscle are chiefly indebted to oatmeal; for porridge (which consists of oatmeal and water, and is eaten with milk) is the staple—almost the only—food of the sturdy Scotch peasantry. South of the parallel of Paris, however, the friendship of oats is little cultivated. In Spain and Portugal nobody knows anything about oats, except as a point of curiosity.

The RYE branch of the grass family travels more to the north than oats in Scandinavia. In our own country we decline to receive gifts from rye. We succeed so well in the cultivation of more wealthy benefactors that we consider the rye poor friends, and, like good Britons, hold them at arms' length accordingly. In countries where the land is poor, poor rye is welcome to a settlement upon it. Rye is in great request in Russia, Germany, and parts of France, and one-third of the population of Europe look to its help for daily bread.

The most numerous and respectable members of the great grass family are those which bear the name of WHEAT. There are an immense number of different wheats: as many wheats among the grasses as there are in this country Smiths among men. We know them best as summer and winter wheats. The family seat of the wheats most probably will never be discovered. There is reason to believe that Tartary and Persia are the native countries of wheat, oats, and rye. Strabo says that wheat is native on the banks of the Indus. Probably, wherever the old seats may be, all trace of them was destroyed in very ancient times, when, even a thousand years ago and more, the plough passed over them. The settlements of wheat in Scotland extend to the north of Inverness; in Norway, to Drontheim; in Russia, to St Petersburg. How far north the wheats would consent to extend the sphere of their influence in America it is not possible to tell, because enough attempt at cultivation has not yet been made there in the northern regions. Winter cold does not concern the wheats: the spring-sown wheat escapes it, and that sown in autumn is protected by a covering of snow. Wheat keeps a respectful distance of twenty degrees from the equator; indeed, in the warm latitudes, new combinations of heat and moisture, grateful to new and very beautiful members of the vegetable world, who suit their gifts more accurately to the wishes of the people whom they feed, would cause the kind offices of wheat to be rejected, even if they could be offered there. On the mountains in warm climates, settlements of wheat of course exist. On the north side of the Himalaya mountains, wheat and barley flourish at a height of thirteen thousand feet.

The well-known name of RICE carries our thoughts to Asia. The family seat is somewhere in Asia, doubtless; but all trace of it is lost. The family has always lived in Southern Asia, where it supplies food, probably, to more men than any other race of plants has ever had occasion to support. No rice can enjoy good health without much heat and much moisture. If these could be found everywhere, everybody would cultivate a valuable friend, that is supposed to scatter over a given surface of ground more than a common share of nourishment.

Most liberal of all vegetables, however, in this respect, are the BANANAS. Humboldt tells us that they spread over the same given extent of ground forty-four times more nutritive matter than the potatoes, and a hundred and thirty-three times more than any wheat.

Where the benevolent among our grasses cease to grow, because it is too far south, there it is just far enough north for the COCOA-NUTS, who, within their limited sphere, supply a vast contribution towards the maintenance of man, that very wise and very independent creature. Very nearly three millions of cocoa-nuts have been exported in one year from the Island of Ceylon.

Then there is in Brazil that excellent vegetable friend, MANIOC, a shrub whose roots yield almost the only kind of meal there used. An acre of manioc is said to yield as much food as six acres of wheat.

And, to come nearer home, there is a large-hearted plant bearing the name of MAIZE, and the nickname of Indian corn. Its native seat has not been fixed yet by the genealogist. It grows at a good height above the sea in tropical America, and it occurs in eastern Europe on the banks of the Dniester, in latitude forty-nine. Maize does not care about the winter; it wants nothing but summer heat in a country which it is to choose as a congenial habitation. It will do also with less heat than the vine; for it has been grown in the lower Pyrenees, at three thousand two hundred and eighty feet above the level of the sea, the vine stopping at two thousand six hundred and twenty.

We have here spoken only of a few of the great liberal families belonging to the world of plants; families to which the human colony looks for support; upon whose aid we, in fact, depend for our existence. The whole list of our vegetable patrons would be very long. Respectable names must crowd down upon every memory, and take us off to

> "Citron groves;
> To where the lemon and the piercing lime,
> With the deep orange, glowing through the green,
> Their lighter glories blend. Lay us reclined
> Beneath the spreading tamarind"—

in fact, take us a long dance among roots, and fruits, and vegetables. It must be enough, therefore, that we have here briefly expressed a general sense of obligation to our vegetable friends, and hinted at a fact which, in our high philosophy, we now and then forget, that the outer world may be a shadow, or a reflex of our own minds, or anything you please to call it; but that we, poor fellows, should be rather at a loss for dinner if the earth did not send up for us, out of a kitchen that we did not build, our corn, and wine, and oil.

—*Household Words.*

BOTANICAL GLEANINGS.

In entering a Botanic Garden it is all very well to see the fine plants, whether trees, shrubs, or flowers, assembled from every clime, and labelled with scientific nomenclature, at the public expense. But were it generally known of what much loved names and truly interesting histories many of the most strange in aspect and unpronounceable in title are possessed, we are convinced that a great and popular thirst for a more familiar acquaintance with botany would be universally excited.

It is not for the purpose of denying the advantage of scientific nomenclature, well settled and of universal acceptance, that we hazard these remarks; but it is because the scientific botanists have manifestly conspired to shut the avenues which admit the diffusion of a vast amount of useful knowledge, out of the arcana of their science, that we complain of their studious care to prevent its taking a popular form. There is only one way, indeed, in which this could be done with safety; and it is by combining the scientific with the popular explanation in so intimate a degree, that the ill-natured adage of Pope may as little hold good as his relative injunction—

> "A little learning is a dangerous thing—
> Drink deep, or taste not the Pierian spring."

The plea for a definite nomenclature and classification in Botany is founded upon the existence of upwards of 100,000 known species of plants; for species are held to include all the individuals separately formed at the creation of the world, and perpetuated ever since. Varieties, exhibiting only minor differences, not incompatible with a common origin, and arising from soil, exposure, and other causes, evince a constant tendency to return to the specific type. But cultivation has produced permanent varieties or *races*, varying much from the original type; as in the cases of the cereal grains—wheat, barley, oats, &c., and culinary vegetables, such as cabbage, cauliflower, turnips, radishes, peas. These permanent varieties were not established all at once, but only after a series of years, and by the art and skill of the gardener or cultivator; and even yet, on a poor soil, and in a neglected condition, there is still a tendency in their seeds to produce the original wild form. Many species, however, vary in a manner so remarkable, that external influences fail to account for it. This is the case with that beautiful and favourite plant the fuchsia. It has produced in successive years flowers differing so much in form and shape that, if they had not been known to be produced by the same plant, they would have been considered as belonging to distinct species. Some, indeed, have of late years advanced the doctrine of transmutation of species, or the conversion of one species into another. They have said that oats may be changed into rye, by being constantly cut down for a series of years before flowering; but there is no foundation for such an opinion. All the species, more nearly allied than others, are grouped together as a distinct kind or *genus*. Roses, for instance, compose a genus distinguished by marked characters. And it was amongst the highest titles Linnæus earned to fame, that he invented the device of giving, in the name of a plant, *the genus* as well as the *species*. *Rosa spinosissima* is a particular species of rose—*Rosa* being the generic; *spinosissima*, the specific, or, as Linnæus called it, the "trivial" name of the plant.

But, after all, it is in the multitude of minute and individual facts, rather than in the classification of names and the conflict of systems, that the value of knowledge in general, and of the knowledge of plants in particular, consists; and often, when the jargon of modern science has grated on our ear, have we longed to live back in the history of human intelligence, that we might, with Shakespeare, be "culling of simples" under the moon, instead of botanising with a microscope.

Let us descend, then, to particulars, and begin with the *Crowfoot* *family*—name familiar to the lover of field flowers. These plants are found in cold, damp climates, and in the elevated regions of warm countries. Europe contains one-fifth of them, and North America about a seventh. The clematis, anemone, ranunculus, or buttercup, hellebore, hepatica, columbine, &c., belong to them. They have narcotic and acrid properties, and are, usually, more or less poisonous. One of them, monkshood, contains a narcotic used as an anodyne, (a medicine which by its soothing qualities assuages pain,) and is chiefly employed where the nerves are affected. The May-apple of America is employed as a purgative; and many of the crow-flowers are marked by bitter tonic properties.

The *Magnolia* family, chiefly found in North America, (certain species also occurring in South America, China, Japan, New Holland, and New Zealand,) may perhaps be familiar in name, if not in appearance. The properties of the order are bitter, tonic, and often aromatic. Captain Winter brought from the Straits of Magellan, in 1579, the magnolia, which yields winter's-bark, employed medicinally as an aromatic stimulant. The bark of swamp-sassafras, or beavér-tree, is, in fact, used as a substitute for Peruvian bark; and the tulip-tree has similar properties.

The *Water-lily* family, to which botanists, with rare felicity, have given the lively name of Nymphacea, have very showy flowers. They adorn the ponds and rivers of North America, and are, generally, widely distributed throughout the northern hemisphere; yet it is in the waters of South America that the *Victoria regia*, one of the largest known aquatics, expands its great flowers, a foot in diameter, with its still larger leaves, which are in diameter from four to six and a half feet, and dispenses its delicious odour.

Of this plant there is a delightful reminiscence wafted from the poetry of L. E. L.:—

> "There floats the water-lily, like a sovereign
> Whose lovely empire is a fairy world;
> The purple dragon-fly above it hovering,
> As when its fragile ivory uncurl'd,
> A long time ago."

The *Lotus*, figured on Egyptian and Indian monuments, is said to belong to the *Water-bean* family of aquatic plants, with showy flowers and floating leaves, found in the temperate as well as the tropical regions of the Old and New World.

The *Sidesaddle flower* family appear in North America and Guiana. To them belongs the remarkable *pitcher-plant* of our swamps, furnished with a leafy receptacle for water, in which are generally to be found the remains of unwary flies and other insects. It has been very extensively used in Nova Scotia, Canada, and Newfoundland, as a remedy for that most loathsome of diseases, the small-pox.

With the *Poppy* family we are, however, more familiar; though few will be prepared to learn that they are chiefly European. This, notwithstanding their extension over tropical America, Asia, China, New Holland, the Cape of Good Hope, &c., is, however, the case. They are distinguished by their milky or coloured juice, and the well-marked narcotic properties of their order. The concrete, milky juice from the unripe capsules of the somniferous poppy is, in fact, opium—the particular plant from which it is procured being a native of Western Asia, and not improbably of Southern Europe also, but now distributed over various other countries besides.

The *Cabbage* or *Cresswort* family are a very extensive order, chiefly European. Everything connected with them goes by fours, generally in the form of a cross. None of them are poisonous, but most of them are antiscorbutic and stimulant. In fact, they are cabbages, cauliflowers, turnips, radishes, cresses, horseradishes, and other garden stuffs most familiar to our readers. Sulphur and nitrogen are contained in them to such an extent, that their decaying odours are anything but agreeable. Not only the garden vegetables, but the more ordinary garden flowers, such as wallflowers, stocks, rockets, honesty, &c., belong to the order. One of the tribe, the rose of Jericho, is remarkable as a *hygrometer*—literally, a measure of the moisture in the surrounding atmosphere; its old withered, annual stems, which are rolled up like a ball in dry weather, and drifted about by the winds in the deserts of Syria and Egypt, resuming when rain falls their original form and direction, and continuing for many years thus to curl up and expand according to the state of the atmosphere. Woad, the plant yielding the well-known woad-blue colour when treated like indigo, and with which the ancient Britons used to dye their bodies, belongs to this order.

The *Caper* family is probably familiar to those who affect a boiled leg of mutton. Capers are the flower-buds of a plant of this order. Their properties are stimulant. The plant is a native of the south of Europe, and is considered by Royle to be the hyssop of Scripture.

Our sweet and pretty favourites, the *Mignonette* family, inhabit Europe and the adjoining parts of Asia. "The uses of the order," says the hard-hearted man of science, "are unimportant." And yet one kind, *weld*, yields a yellow dye; another is the fragrant mignonette. Ah! how many hearts has not that gentle fragrance solaced! In the lone garret it has blended with the inmates' sighs, and mingled with the quick, warm breathings of emotion on the lordly parterre. The mignonette is in France an object of such favourite culture that, by preventing the development of its blossoms, it is common to render it shrubby or woody, when it is known as the tree-mignonette. We shall conclude this short excursion into botany with a notice of the *Violet* family. They are natives of Europe, Asia, and America. They possess many valuable medicinal properties. The roots of the sweet-scented European violet have been employed as an emetic. Other species are used in South America as substitutes for ipecacuanha. The rich odour of the Eastern violets is almost entirely absent in those of the western hemisphere. The only North American species possessing any degree of fragrance is the tall *Viola Canadensis*, which flowers twice a year—in the spring and fall. The *Viola tricolor* (heart's-ease) is the origin of all the cultivated varieties of pansy.

—*Adapted from* W. W. FYFE.

LINNÆUS NAMING THE FLOWERS.

IT is pleasant to trace the steps of a genius like Linnæus going over completely new ground in the wide field of natural history; classing and naming birds, insects, and flowers, oftentimes according to a system which his own ingenuity and penetration had devised to supply the deficiencies of former naturalists. An active examination of the minuter parts of the object under his consideration, frequently enabled him to arrive at a juster conclusion as to the order or genus to which it belonged, than others who had preceded him; and sometimes, after having with indefatigable industry ascertained these points, he indulged himself in combining with his new discovery associations of friendship, or of historical or classical allusion. After this fashion he honoured several of his patrons and pupils. Thus the *Celsia* was so named after Celsui, one of his earliest benefactors; and the *Kalmia*, now so well known in our gardens, commemorated his friendship for Professor Kalm, his pupil and fellow-labourer. In his "Critica Botanica" he observes, concerning this habit of the appropriation of celebrated names to the genera of plants, that "a proper connexion should be observed between the habits and appearance of the plant and the name from which it has its derivation;" and as an emblem of himself he chose the *Linnæa*

LINNÆA BOREALIS.

borealis,* which he described as "a little northern plant flowering early, depressed, abject, and long overlooked." It was gathered by him at Lycksele, May 29, 1732. It is common in West Bothnia, and in almost all the great northern forests; but it may be easily overlooked, because it grows only where the woods are thickest, and its delicate twin-blossoms are almost hid among the moss, and interwoven with ivy. Their smell resembles that of the meadow-sweet, and is so strong during the night as to discover the plant at a considerable distance.

When he received his patent of nobility, Linnæus adopted this

* This little plant is to be found abundantly in the temperate regions of the North American continent.

floweret as a part of his crest—the helmet which surmounts the arms of his family being adorned with a sprig of Linnæa. One of those pupils who visited distant countries to add to the collections of his great master, sent from China a service of porcelain, manufactured purposely for him, having a representation of this plant as its only decoration; and the Cardinal de Noailles erected a cenotaph in his garden to the memory of the naturalist, and planted the Linnæa by its side as its most appropriate ornament. What lover of flowers but will regard with interest this little flower of the north, for the sake of him whose name it bears!

—C. L. Brightwell.

TO THE FRINGED GENTIAN.

Thou blossom, bright with autumn dew,
And colour'd with the heaven's own blue,
That openest when the quiet light
Succeeds the keen and frosty night;

Thou comest not when violets lean
O'er wandering brooks and springs unseen,
Or columbines, in crimson drest,
Nod o'er the ground-bird's hidden nest.

Thou waitest late and com'st alone,
When woods are bare and birds are flown,
And frosts and shortening days portend
The aged year is near its end.

Then doth thy sweet and quiet eye
Look through its fringes to the sky,
Blue,—blue—as if that sky let fall
A flower from its cerulean wall.

I would that thus when I shall see
The hour of death draw near to me,
Hope, blossoming within my heart,
May look to heaven as I depart.

—Bryant.

TROPICAL SCENERY.

On leaving Ascension we sailed for Bahia, on the coast of Brazil, in order to complete the chronometrical measurement of the world. We arrived there on August 1st, and stayed four days, during which I took several long walks. I was glad to find my enjoyment in tropical scenery had not decreased from the want of novelty, even in the slightest degree. The elements of the scenery are so simple, that they are worth mentioning, as a proof on what trifling circumstances exquisite natural beauty depends.

The country may be described as a level plain of about three hundred feet in elevation, which in all parts has been worn into flat-bottomed valleys. This structure is remarkable in a granitic land, but is nearly universal in all those softer formations of which plains are usually composed. The whole surface is covered by various kinds of stately trees, interspersed with patches of cultivated ground, out of which houses, convents, and chapels arise. It must be remembered that within the tropics, the wild luxuriance of nature is not lost even in the vicinity of large cities; for the natural vegetation of the hedges and hill-sides overpowers in picturesque effect the artificial labour of man. Hence, there are only a few spots where the bright red soil affords a strong contrast with the universal clothing of green. From the edges of the plain there are distant views either of the ocean, or of the great Bay with its low-wooded shores, and on which numerous boats and canoes show their white sails. Excepting from these points, the scene is extremely limited; following the level pathways on each hand, only glimpses into the wooded valleys below can be obtained. The houses, I may add, and especially the sacred edifices, are built in a peculiar and rather fantastic style of architecture. They are all whitewashed; so that when illumined by the brilliant sun of mid-day, and as seen against the pale blue sky of the horizon, they stand out more like shadows than real buildings.

Such are the elements of the scenery, but it is a hopeless attempt to paint the general effect. Learned naturalists describe these scenes of the tropics by naming a multitude of objects and mentioning some charac eristic feature of each. To a learned traveller this possibly may communicate some definite ideas: but who else, from seeing a plant in an herbarium, can imagine its appearance when growing on its native soil? Who, from seeing choice plants in a hothouse, can magnify some into the dimensions of forest trees, and crowd others into an entangled jungle? Who, when examining in the cabinet of the entomologist the gay exotic butterflies, and singular cicadas, will associate with these lifeless objects, the ceaseless harsh music of the latter, and the lazy flight of the former,—the sure accompaniments of the still, glowing noonday of the tropics? It is when the sun has attained its greatest height that such scenes should be viewed: then the dense splendid foliage of the mango hides the ground with its darkest shade, whilst the upper branches are rendered, from the profusion of light, of the most brilliant green. In the temperate zones the case is different—the vegetation there is not so dark or so rich, and hence the rays of the declining sun, tinged of a red, purple, or bright yellow colour, add most to the beauties of those climes.

When quietly walking along the shady pathways, and admiring each successive view, I wished to find language to express my ideas. Epithet after epithet was found too weak to convey to those who have not visited the intertropical regions, the sensation of delight which the mind experiences. I have said that the plants in a hothouse fail to communicate a just idea of the vegetation, yet I must recur to it. The land is one great, wild, untidy, luxuriant hothouse, made by Nature for herself, but taken possession of by man, who has studded it with gay houses and formal gardens. How great would be the desire in every admirer of nature to behold, if such were possible, the scenery of another planet! yet to every person in Europe, it may be truly said, that, at the distance of only a few degrees from his native soil, the glories of another world are opened to him. In my last walk I stopped again and again to gaze on these beauties, and endeavoured to fix in my mind for ever an impression which, at the time, I knew sooner or later must fail. The form of the orange-tree, the cocoa-nut, the palm, the mango, the tree-fern, the banana, will remain clear and separate; but the thousand beauties which unite these into one perfect scene must fade away, yet they will leave, like a tale heard in childhood, a picture full of indistinct, but most beautiful figures.

—DARWIN'S *Journal.*

VEGETABLE CLOTHING—FLAX, HEMP, AND COTTON.

THE *vegetable* matters employed for clothing are chiefly of two kinds: the fibres of plants, and the downy substance in which the seeds are sometimes embedded. The fibrous or stringy texture is very prevalent in vegetables. We see it in the bark and wood of trees, in the stalks of green or herbaceous plants, and in the leaves of all. The longer parallel fibres are held together by shorter cross ones, forming a network, cemented by a glutinous matter. The ingenious, though but half-civilised people of Otaheite have discovered a method of making tolerable cloth of the inner bark of certain trees, by steeping it in water, and then beating it with a wooden mallet. But the more artful way of employing vegetable fibres consists in an entire separation of them from the matter that held them together, reducing them to clean loose bundles, then twisting them into threads, and lastly interweaving them.

The plants selected in Europe for the purpose of making thread and cloth from their fibres are chiefly flax and hemp. *Flax* (in Latin *linum*, whence the word *linen*) is an annual plant, rising on a single stalk to a moderate height, and crowned with handsome blue flowers, succeeded by globular seed-vessels. It is suffered to grow till the seeds are ripe, and is then plucked up by the hand, laid in little bundles to dry, deprived of its seed-vessels, and then put into pits of water to rot. The purpose of this part of the process is to dissolve a mucilaginous matter, which holds the fibres together; and

FLAX PLANT.

it is the most disagreeable part of the management of flax, as the smell arising from it while rotting is extremely offensive, and prejudicial to the health. When the flax has lain long enough, it is taken out, washed, dried, then beaten with mallets, combed, and by various other operations so prepared, that the long fibres are got by themselves, clean and loose, in which state they are called *flax;* the shorter and coarser fibres, separated by the comb, are called *tow.* The operation of spinning, which it next undergoes, consists in drawing out, with the fingers, several of the fibres together, and twisting them. The product of spinning is thread, which is more or less fine according to the dexterity of the spinner and the nature of the material. Some thread closer twisted than the rest is kept for needlework, but the greater part is made up in bundles, called linen-yarn, and committed to the weaver.

Weaving may be regarded as a finer kind of matting. To perform it, the threads, which form the length of a piece of cloth, are first disposed in order, and strained by weights to a proper tightness; this is called the *warp.* These threads are divided by an instrument called a reed, into two sets, each composed of every other thread; and while, by the working of a treadle, each set is thrown alternately up and down, the cross-threads, called the *woof* or *weft,* are inserted between them, by means of a little instrument, sharp at both ends, called a shuttle, which is briskly shot from one of the weaver's hands to the other, placed on the opposite sides of the work, and carries the thread with it. This is the simplest kind of weaving; but numberless are the additional contrivances made for all the curious works wrought in the loom which have been the objects of human ingenuity for many ages.

The linen fabrics are of all degrees of fineness, from coarse sheeting to cambric, almost emulating a spider's web. They are brought to that extreme whiteness, which we so much admire, by the process of bleaching. This consists in their exposure to the action of the sun and air, with frequent watering, and often with the help of some acid liquor, which quickens the operation. The value that can be given to a raw material by manufacturing, is in few instances more strikingly exemplified than in the conversion of flax into Brussels lace, some of which sells for several guineas a yard. Indeed, if you look at a plant of flax growing, and then at the frill of your shirt, you cannot fail to be struck with admiration of human skill and industry.

Hemp is a much taller and stronger plant than flax. It has a square rough stalk, rising to the height of five or six feet, and sending off branches. Its fibrous part consists in the bark surrounding the main stalk. Hemp undergoes the same general preparation as flax before it is consigned to the weaver; but, being of a stronger and coarser texture, it requires more labour to get the fine fibres separate from the rest. Hence it is commonly employed in the more homely manufactures; it is the principal material of sailcloth, a fabric, the strength of which is required to be proportional to the violence it has to undergo from storms and tempests; and it is equally important to navigation, from its use in making cordage; for which purpose it is taken nearly in a raw state, and twisted into coarse twine, which is afterwards united to make rope.

Whilst the inhabitant of the northern and temperate regions is obliged to exercise much labour and contrivance in procuring his vegetable clothing from the stalks of plants, the native of the fruitful south enjoys the benefit of a material presented in greater abundance, and in a state requiring much less preparation before it is fitted for the manufacturer. This is *cotton*, a white woolly substance contained in the seed-pod of a family of plants, some of which are annual and herbaceous, others perennial and shrubby. The pods, when ripe, open of themselves, and the cotton is plucked

The figure represents a species of cotton plant found in India, and shows the manner in which the cotton escapes from the capsule.

out of them by the fingers, with the seeds sticking to it; these are separated by means of mills, which pull out and loosen the down. It is then in a state fit to be sent from the planter to the manufacturer. The farther operations it undergoes are picking, carding, and roving, which last brings off the fibres longitudinally in a continued loose line; these are next twisted and drawn out, so as to make thread or yarn, and the material is then consigned to the weaver. The vast extension of the cotton manufacture in this country has caused these preparatory operations to be performed by a system of complex machinery, the invention of the late Sir Richard Arkwright.

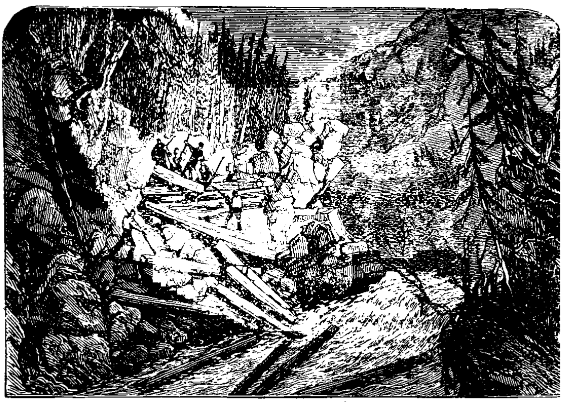
The fabrics made from cotton are probably more various and numerous than from any other material. They comprehend stuffs of all degrees of fineness, from the transparent muslin of a robe, or a turban, to the thick plush and warm bed-quilt. The commerce of Great Britain has, of late years, been peculiarly indebted to the cotton manufacture, which produces clothing for people of all ranks, from Russia to Guinea, and unites elegance with cheapness in an unusual degree. Great quantities of the native fabrics of the East are also imported into Europe. Some of these, from excellence in the material and incomparable manual dexterity and patience in the workmen, though made with very simple machinery, equal in fineness and beauty anything of European manufacture. The natives are said to perform their finest work in moist cool places under ground, which makes the cotton hold together so as to draw out to the thinnest threads; and the soft and delicate fingers of the Indian women give them the sense of feeling to a degree of nicety much beyond that of Europeans.

It is probable that cotton at present clothes more people in the world than any other substance. Its peculiar advantage, besides cheapness, is the union of warmth with lightness, whence it is fitted for a great variety of climates. To the hot it is better adapted than linen, on account of its absorbing quality, which keeps the skin dry and comfortable. The woolliness of cotton gives a kind of nap to the cloth made of it, which renders it soft to the touch, but apt to attract dust. In the fine muslins this is burned off, by passing them between heated cylinders with such velocity as not to take fire, which, considering the combustibility of cotton, must be a very nice operation.

—Dr Aikin.

LUMBERING.

The lumber trade is carried on to a greater or less extent on almost all the American rivers; but on the Mississippi and the St Lawrence it affords employment to a vast number of persons. The chief raftsmen, under whose directions the timber expeditions are conducted, are generally persons of very great intelligence, and often of considerable wealth. Sometimes these men, for the purpose of obtaining wood, purchase a piece of land, which they sell after it has been cleared, but more frequently they purchase only the timber from the



proprietors of the land on which it grows. The chief raftsman, and his detachment of workmen, repair to the forest about the month of November, and are occupied during the whole of the winter months in felling trees, dressing them into logs, and dragging them by teams of oxen to the nearest stream, over the hardened snow, with which the country is then covered. They live during this period in huts formed of logs. Throughout the whole of the newly cleared districts of America indeed, the houses are built of rough logs, which are arranged so as to form the four sides of the hut, and their ends are half-checked into each other in such a manner as to allow of their coming into contact nearly throughout their whole length, and the small interstices which remain are filled up with clay. About the month of May, when the ice leaves the rivers, the logs of timber that have been prepared, and hauled down during winter, are launched into the numerous small streams in the neighbourhood of which they have been cut, and are floated down to the larger rivers, where their progress is stopped by what is called a "boom." The boom consists of a line of logs, extending across the whole breadth of the river. These are connected by iron links, and attached to stone piers built at suitable distances in the bed of the stream.

The boom is erected for the purpose of stopping the downward progress of the wood, which must remain within it till all the timber has left the forest. After this every raftsman searches out his own timber, which he recognises by the mark he puts on it, and, having formed it into a raft, floats it down the river to its destination. The boom is generally owned by private individuals, who levy a toll on all the wood collected by it. The toll on the Penobscot River is at the rate of three per cent. on the value of the timber.

The rafts into which the timber is formed, previous to being floated down the large rivers, are strongly put together. They are furnished with masts and sails, and are steered by means of long oars, which project in front as well as behind them. Wooden houses are built on them for the accommodation of the crew and their families. I have counted upwards of thirty persons working the steering oars of a raft on the St Lawrence; from this some idea may be formed of the number of their inhabitants.

The most hazardous part of the lumberer's business is that of bringing the rafts of wood down the large rivers. If not managed with great skill, they are apt to go to pieces in descending the rapids; and it not unfrequently happens that the whole labour of one, and sometimes of two years, is in this way lost in a moment. An old raftsman with whom I had some conversation on board of one of the steamers on the St Lawrence, informed me that each of the rafts brought down that river contains from 15,000 to 25,000 dollars' worth of timber, and that he, on one occasion, lost 12,500 dollars by one raft, which grounded in descending a rapid, and broke up. The safest size for a raft, he said, was from 40,000 to 50,000 square feet of surface; and when of that size they require about five men to manage them. Some are made, however, which have an area of no less than 300,000 square feet. These unwieldy craft are brought to Quebec in great numbers from distances varying from one to twelve hundred miles; and it often happens that six months are occupied in making the passage. They are broken up at Quebec, where the timber is cut up for exportation into planks, deals, or battens, at the numerous saw-mills with which the banks of the St Lawrence are studded for many miles, in the neighbourhood of the town. Sometimes the timber is shipped in the form of logs. The timber-rafts of the Rhine are, perhaps, the only ones in Europe that can be compared to those of the American rivers; but none of those which I have seen on the Rhine were nearly so large as those on the St Lawrence, although some of them were worked by a greater number of hands, a precaution rendered necessary, perhaps, by the more intricate navigation of the river. The principal woods exported from the St Lawrence are white oak, white pine, red pine, elm, and white ash.

—STEVENSON.

THE LINDEN TREE.

HERE 's a song for thee—of the linden tree!
  A song of the silken lime!
There is no other tree so pleaseth me,
  No other so fit for rhyme.

When I was a boy, it was all my joy
  To rest in its scented shade,
When the sun was high, and the river nigh
  A musical murmur made.

When floating along, like a winged song,
  The traveller-bee would stop,
And choose for his bower the lime-tree flower,
  And drink—to the last sweet drop.

When the evening star stole forth, afar,
  And the gnats flew round and round,
I sought for a rhyme beneath the lime,
  Or dream'd on the grassy ground.

Ah! years have fled; and the linden dead,
  Is a brand on the cottier's floor,
And the river creeps through its slimy deeps,
  And youth—is a thought of yore!

Yet—they live again, in the dreamer's brain,
  As deeds of love and wrong,
Which pass with a sigh, and seem to die,
  Survive in the poet's song.

—BARRY CORNWALL.

TIM LINKINWATER'S WINDOW.

(From "Nicholas Nickleby.")

"THERE is a double wallflower at No. 6 in the court, is there?" said Nicholas.

"Yes, there is," replied Tim, "and planted in a cracked jug without a spout. There were hyacinths there this last spring, blossoming in—but you 'll laugh at that, of course."

"At what?"

"At their blossoming in old blacking-bottles," said Tim.

"Not I, indeed," returned Nicholas.

Tim looked wistfully at him for a moment, as if he were encouraged by the tone of this reply to be more communicative on the subject; and sticking behind his ear a pen that he had been making, and shutting up his knife with a sharp click, said, "They belong to a sickly, bed-ridden, humpbacked boy, and seem to be the only pleasures, Mr Nickleby, of his sad existence. How many years is it," said Tim, pondering, "since I first noticed him, quite a little child, dragging himself about on a pair of tiny crutches? Well! well! not many; but though they would appear nothing, if I thought of other things, they seem a long, long time, when I think of him. It is a sad thing," said Tim, breaking off, "to see a little deformed child sitting apart from other children, who are active and merry, watching the games he is denied the power to share in. He made my heart ache very often."

"It is a good heart," said Nicholas, "that disentangles itself from the close avocations of every day, to heed such things. You were saying"——

"That the flowers belonged to this poor boy," said Tim, "that's all. When it is fine weather, and he can crawl out of bed, he draws a chair close to the window, and sits there looking at them, and arranging them all day long. We used to nod at first, and then we came to speak. Formerly, when I called to him of a morning, and asked him how he was, he would smile and say, 'Better,' but now he shakes his head, and only bends more closely over his old plants. It must be dull to watch the dark house-tops and the flying clouds for so many months; but he is very patient."

"Is there nobody in the house to cheer and help him?" asked Nicholas.

"His father lives there, I believe," replied Tim, "and other people, too; but no one seems to care much for the poor sickly cripple. I have asked him very often if I can do nothing for him; his answer is always the same—'Nothing.' His voice has grown weak of late, but I can see that he makes the old reply. He can't leave his bed now, so they have moved it close beside the window; and there he lies all day, now looking at the sky, and now at his flowers, which he still makes shift to trim and water with his own thin hands. At night, when he sees my candle, he draws back his curtain, and leaves it so till I am in bed. It seems such company to him to know that I am there, that I often sit at my window for an hour or more, that he may see I am still awake; and sometimes I get up in the night to look at the dull, melancholy light in his little room, and wonder whether he is awake or sleeping."

"The night will not be long coming," said Tim, "when he will sleep and never wake again on earth. We have never so much as shaken hands in all our lives, and yet I shall miss him like an old friend. Are there any country flowers that could interest me like these, do you think? Or do you suppose that the withering of a hundred kinds of the choicest flowers that blow, called by the hardest Latin names that were ever invented, would give me one fraction of the pain that I shall feel when these old jugs and bottles are swept away as lumber? Country!" cried Tim, with a contemptuous emphasis; "don't you know that I couldn't have such a court under my bedroom-window anywhere but in London?"

With which inquiry Tim turned his back, and, pretending to be absorbed in his accounts, took an opportunity of hastily wiping his eyes, when he supposed Nicholas was looking another way.

—CHARLES DICKENS.

ANCIENT AND MODERN FARMING.

IN early times, when the population was scattered widely over the land, and their wants were few and easily satisfied, the spontaneous products of the earth, scanty as they were, would amply suffice. But as the people increased in numbers, and civilisation progressed, attempts would be made to extend the products of the land by the efforts of industry and skill. The cereal crops would then be cultivated, and farinaceous food used to supplement the spontaneous herbage of the soil. But the system of culture this discovery inaugurated was confined solely to the preparing of the land to receive the seed, not to any attempts to stimulate its productiveness. What the land naturally yielded would be considered as the extent of its capability. The nature of all agricultural processes for ages was simple in the extreme, progress being retarded by the devastating wars and civil discords which for many ages afflicted all the nations of Europe. The husbandman reaped his tiny crop beneath the shade of the feudal castle, and was ready at the shout of the warder, or the trumpet call, to throw down the sickle and seize the sword; and it was long ere he left this sheltering shade, and cultivated the valleys, and crept up the hill-side; dotting the smiling landscape with his flocks of sheep and cattle, and adding to the beauty of the scene by the glistening glories of the summer corn. But long after intestine wars had ceased, when the rusty firelock or the notched sabre were the only relics of the troublous times we have alluded to, agriculture still presented the same torpid symptoms, and little evidence was shown of the desire to increase the natural productiveness of the soil by improved methods of treatment. It was very early discovered that the cereal crops were exhaustive ones—that is, if crop after crop of the same grain was raised from the same patch of soil, it was observed soon to be incapable of further production, at least to any amount. This proved that the crop withdrew certain properties of the soil. In districts where land was plentiful and easily obtained, this difficulty would be got rid of by cultivating new patches of soil, just in the same way now followed by the careless farmer in America, who crops until he exhausts his land, when he moves off to another "location," where virgin land, abounding in all the elements of fertility, is to be had, which in its turn undergoes the same process of exhaustion. In process of time, the lands which were discarded as exhausted and incapable of producing crops would be returned to, or taken into cultivation by other hands, the result being that crops would be raised as before. This necessarily attracting attention, and the fact becoming registered, that exhausted land would again become productive if allowed to remain uncultivated—that is, at rest—for a certain period, the "fallow" system was inaugurated. The old Roman system consisted in raising a crop of grain one year, allowing the land to remain at rest the next. In this country* a variety of circumstances tended to introduce a peculiar system of agriculture; the exigencies of a population concentrated in a much greater degree than in any other of the European states; the length of the winter, and the uncertainty even of the favourable months; the comparative scarcity and dearness of land, and the existence of a

* Britain; but applicable to British America in many particulars.

higher degree of exhaustive property in the cereals than in the southern countries; the natural richness of the herbage of the fields —all induced a comparatively peculiar system. As daily experience registered facts, the truth would soon become apparent that it was not necessary to wait for the land becoming again productive by allowing it to lie a comparatively long period idle; that the fertilising properties could be restored to it by the addition of manure, this being obtained from the stock of the farm—the cattle, sheep, horses, cows, &c. The increase, therefore, of the cereal productiveness of the land evidently depended upon the amount of manure placed at the disposal of the farmer; hence the efforts to increase the number of stock kept. At first the system was much aided by the spontaneous growth of large crops of grass—one of the peculiarities of our climate. The plan adopted, therefore, was to have half the farm devoted to pasture lands, and half to the cultivation of cereals, a portion of this latter half being kept in fallow. But the exigencies of our climate placed a limit to the number of cattle kept, and, in consequence, the amount of manure produced. For a large portion of the year the herbage is liable to be frozen or covered with snow; the animals are, in consequence, unable to partake of it. It became necessary, therefore, if the stock was to be increased on our farms, to provide a supply of food by which to maintain the animals during the severe weather of winter, these being housed, instead of starving in the open fields, as in the old system. The want being thus felt, it was in time supplied by the introduction of what are known as the *green crops*—artificial grasses, and roots, as turnips, exclusively raised for the maintenance of the stock. As this system was adopted, the breadth of land under fallow, and latterly that under the cereal crops, was diminished. In process of time the grand principle which completely revolutionised agriculture was introduced; we refer to the "Rotation of Crops," or the "Four Year Course System." This was founded upon the theory that forage plants derive the principal elements of their growth from the atmosphere giving to the soil more than they take from it, and afford in addition a large amount of manure when consumed by stock; thus they contribute in two ways to the refertilisation of the soil exhausted by the cereal crops, which derived their nutriment, to a great extent, from the inorganic or mineral constituents of the soil. This system once fairly established, all the other improvements of modern agriculture, such as drainage, subsoiling, irrigation, and steam cultivation, followed in comparatively quick succession.

—BURN'S *Outlines of Modern Farming.*

THE TOY OF THE GIANT'S CHILD.

(From the German of Chamisso.)

Burg Niedeck is a mountain in Alsace, high and strong,
Where once a noble castle stood—the giants held it long;
Its very ruins now are lost, its site is waste and lone,
And if you seek for giants there, they are all dead and gone.
The giant's daughter once came forth the castle-gate before,
And played with all a child's delight, beside her father's door;
Then sauntering down the precipice, the girl did gladly go,
To see, perchance, how matters went in the little world below.
With few and easy steps she passed the mountain and the wood;
At length near Haslach, at the place where mankind dwelt, she
stood;
And many a town and village fair, and many a field so green,
Before her wondering eyes appeared, a strange and curious scene.
And as she gazed, in wonder lost, on all the scene around,
She saw a peasant at her feet, a tilling of the ground;
The little creature crawled about so slowly here and there,
And, lighted by the morning sun, his plough shone bright and fair.
"O pretty plaything!" cried the child, "I'll take thee home with
me;"
Then with her infant hands she spread her kerchief on her knee,
And cradling horse, and man, and plough, all gently on her arm,
She bore them home with cautious steps, afraid to do them harm:
She hastes with joyous steps and quick, (we know what children
are,)
And spying soon her father out, she shouted from afar—
"O father, dearest father, such a plaything I have found,
I never saw so fair a one on all our mountain ground."
Her father sat at table then, and drank his wine so mild,
And smiling with a parent's smile, he asks the happy child—
"What struggling creature hast thou brought so carefully to me?
Thou leap'st for very joy, my girl; come, open, let us see."
She opes her kerchief carefully, and gladly, you may deem,
And shows her eager sire the plough, the peasant, and his team;
And when she'd placed before his sight the new-found pretty toy,
She clasped her hands, and screamed aloud, and cried for very joy.
But her father looked quite seriously, and shaking slow his head,
"What hast thou brought me home, my child? This is no toy,"
he said;

"Go, take it quickly back again, and put it down below;
The peasant is no plaything, girl—how couldst thou think him so?
So go, without a sigh or sob, and do my will," he said;
"For know, without the peasant, girl, we none of us had bread;
'Tis from the peasant's hardy stock the race of giants are;
The peasant is no plaything, child—no, God forbid he were."
—RICHARDSON.

ZOOLOGY.

ZOOLOGY, as you have already learned, is that branch of natural science which treats of animals, including not only the quadrupeds or four-footed beasts to which the name "animal" is generally applied, but all living creatures as distinguished from plants. Between the many different animals which inhabit the various portions of land and water that constitute our earth, there are points of resemblance more or less striking, making, what we may term, a family likeness; and the zoologist, taking advantage of these, arranges all the members of the animal kingdom under certain classes, divisions, and families. My object, in this lesson, is to introduce to your notice the five great divisions, or, as they are called, sub-kingdoms of the animal world.

The first and most important of these great divisions is the sub-kingdom *Vertebrata.* It comprises all those animals which possess an internal skeleton, of which the principal feature is a spine or backbone, composed of numerous smaller bones, called "vertebræ," fitting into one another with the greatest nicety. To this spine or main column all the other bones are attached by joints of different kinds, suited to the functions which the animal has to perform. While preserving the same general character, these bones or limbs differ greatly in appearance in different classes of animals; thus, if we take the fore pair of limbs which nearly all the vertebrates possess, we find them represented by the arms of man, the legs of the horse, the flappers of the whale, the wings of birds, and the fins of fishes. The tail also, which is almost or entirely wanting in some groups, is enormously developed in others. We must be careful not to mistake outward resemblance for real relationship; a humming-bird, for instance, is not unlike a dragon-fly, and a turtle has something the appearance of a crab; yet, while the humming-bird and the turtle are both members of the vertebrate sub-kingdom, the dragon-fly and the crab belong to one totally distinct from it. This important division of the animal kingdom has five subdivisions or classes, well known to you as *mammals*, *birds*, *reptiles*, *amphibians*, and *fishes*.

The second of the great provinces of zoology is occupied by the sub-kingdom *Articulata*. Under it are comprehended the numerous tribes of animals that, possessing no internal skeleton, wear their bones outside, in the shape of a hard or horny covering. Their bodies appear half-divided into segments, generally three in number; the name of the sub-kingdom, indeed, means *jointed*, and, like the word *vertebrate*, comes from the Latin. Each of these segments, as a rule, bears two pairs of members, such as wings, legs, and feelers, or antennæ. No individual of this great sub-kingdom possesses less than six legs, while in some of them these useful members may be counted by the hundred. Crabs, spiders, insects, and worms are some of the classes into which the Articulata are divided.

The third place on our list is reserved for the *molluscs*. The Mollusca are soft-bodied animals, having no skeleton either exterior or interior, but, to protect their pulpy bodies from injury, they are generally provided with a shell. This shell may either be all in one piece, like that of the common snail, or it may consist of two valves opening by a hinge, as in the case of the clam or oyster. Some molluscs—the slugs, for instance—have no shell, or, at any rate, so very small a one that it serves no useful purpose, being a mere ornament upon the tip of the poor animal's tail. To this interesting sub-kingdom belong the voracious cuttle-fish and the beautiful nautilus, snails, and barnacles, and all those fresh and salt water animals which we designate *shell-fish*.

Keeping still to the water, we are introduced to the fourth great division, which bears the name of *Radiata*. The radiates are so called because, their mouths being in the centre of the body, all the other parts radiate from it like spokes from the nave of a wheel. None of the animals of this sub-kingdom attain a great size, yet, strange to say, islands of considerable magnitude owe their origin to one of the smaller classes into which it is divided. This class you will at once recognise as the coral insects, although they are not insects at all, but marine animals, possessing a name of their own, *polypes*, which is a Greek work, signifying "many-footed." Besides the polypes, we find in this division horny star-fishes, prickly sea-urchins, transparent jelly-fish, that melt away when taken out of the water, and many other curious tribes.

Finally, we arrive at the very outskirts of the animal kingdom, where the minute *protozoa* call for a farewell notice. The name Protozoa is improperly given to an animal sub-kingdom, being Greek, while all the others—Vertebrata, Articulata, Mollusca, and Radiata—are Latin; it means "first animals," since the creatures comprehended under it are the lowest in the scale of animal life, and show the point at which it may be said to commence. The protozoa are very small, by far the larger number of them being microscopical; they seem to have no organs, and to be mere masses of floating jelly. Sponges, and animalcules inhabiting water of all kinds, are the principal members of the last of the animal sub-kingdoms.

Typical forms of the five animal sub-kingdoms—

The animal kingdom is divided into

Sub-kingdoms.
1. Vertebrata.
2. Articulata.
3. Mollusca.
4. Radiata.
5. Protozoa.

VERTEBRATE ANIMALS.

The Vertebrated sub-kingdom, including the classes of mammals, (animals which suckle their young,) birds, reptiles, batrachians, (or amphibians, the frog family,) and fishes, is characterised by the presence, in all its members, of an internal skeleton composed of bone or cartilage, and forming an envelope to the nervous centres. In the Articulated classes, there is no vestige of any such structure; and the only mollusca (some of the cuttle-fish tribe) in which there is the least approach to it are sufficiently distinguished by other characters. It is true that among many of the Radiata—such as a few of the jelly-fish tribe and a large proportion of the polypes—there is an internal skeleton, sometimes composed of a horny or cartilaginous tissue, and sometimes possessing even a stony hardness; but this gives equal support to the whole fabric, and is not arranged in such a manner as to give the least degree of peculiar protection to the nervous centres; so that, although it may be fancifully regarded as a kind of sketch or shadowing forth in this lowest group of the plan of structure which is characteristic of the highest, it cannot be said to have any real correspondence with it.

The animals of the Vertebrated series are, of all sentient beings, those whose faculties are the most varied and the most perfect. The principle of the division of labour is carried out in them to its highest degree; every function to be performed having its own separate organ whose operations are limited to it alone; consequently, the Vertebrata are, of all animals, those in which the distinct organs are the most numerous and the most complicated. We may encounter many among the lower tribes in which the number of parts is as great or even greater; but where this is the case, most of these parts are but repetitions of one another. It is by the variety existing in the form and structure of their several organs, and in the perfection with which each is adapted to perform its allotted function, that the Vertebrata are chiefly characterised. It is manifest that the structure of such animals must be regarded as more elaborate than that of beings in which the number of dissimilar parts is small, and every one of them capable of discharging a variety of offices; and that their functions must be performed with more energy and completeness, when carried into effect by instruments peculiarly adapted to each, than when several are the result of the actions of one organ. Hence we are justified in ranking the Vertebrata as the highest group in the animal scale, independently of its being the one which contains Man. But we are not justified in speaking of the animals composing it as more perfectly constructed than any others; since, in the eye of the Creator, they must be all equally perfect. In every one, the adaptation between the actions of its several parts must be complete; or it could not maintain its existence. And it should not be less wonderful to us to meet in the zoophyte with a simple structure capable of performing all the functions of absorption, assimilation, respiration, and secretion, than to contemplate the numerous and elaborately constructed organs by which these several operations are respectively performed in the Vertebrated animal.

—CARPENTER.

Sub-kingdom Vertebrata.

1. Mammals are: *a.* Two-handed—Man; *b.* Four-handed—Monkeys; *c.* Wing-handed—Bats; *d* Insect-eating—Moles, &c.; *e.* Flesh-eating—beasts of prey; *f.* Fish-like—Whales, &c.; *g.* Gnawing—Squirrel, Rat, &c.; *h.* Toothless—Sloth, &c.; *i.* Ruminating—Ox, Sheep, &c.; *k.* Thick-skinned—Elephant, Horse, Pig, &c; *l.* Pouched—Opossum, Kangaroo, &c.
2. Birds are: *a.* Birds of prey—Eagle, Owl, &c.; *b.* Perchers—Song-birds, &c.; *c.* Climbers—Woodpecker, Parrot, &c.; *d.* Scratchers—Fowls; *e.* Waders—Bittern, &c.; *f.* Swimmers—Geese, &c.; *g.* Runners—Ostrich, &c.
3. Reptiles are: *a.* Turtles, &c.; *b.* Crocodiles; *c.* Lizards; *d.* Serpents.
4. Batrachians are: *a.* Frogs, &c; *b.* Salamanders, &c.; *c.* Sirens; *d.* and *e.* Footless and Fishlike Batrachians.
5. Fishes are: *a.* Enamelled—Sturgeons, &c.; *b.* Cartilaginous—Sharks, &c.; *c.* Spiny—Perch, &c.; *d.* Soft-finned—Salmon, &c.

NATURE IN MOTION.

MAMMALIA.

THE Mammalia do not roam and rove so much as the lighter birds and favoured fishes; they are generally bound to certain localities, and, at all events, chained to the soil. Still we find among them also travellers, now driven forth by hunger, and now by an overwhelming number of beasts of prey, to seek new pastures and new dwelling-places. Others, again, follow man in his migrations over the globe, and thus spread from country to country. To the former belong the horses which now roam wild on the plains of South America, and travel at times thousands of miles. The wild asses, also, in the wilderness, "which stand up in the high places and snuff the wind like dragons," travel in bands of two or three hundred, and leave, in winter, the tropics for a still warmer region in the south of Africa. They are called "the Bushman's harvest," for the wild Bushman hunts and consumes what has been left by the royal lion and the hungry vulture, who follow them in their march, and feast upon them for a season. Gazelles and antelopes migrate in like manner; and even huge elephants are seen wandering in large herds over the boundless plains of Africa. The shaggy buffalo roams in vast numbers over the prairies of the American continent, and migrates at regular intervals from the north to the south, and from the plain to the mountain. Salt springs are with them the great centre of attraction; but generally their movements seem to be regulated by the state of their pastures. As soon as the fire has spread over a prairie, and is succeeded by a fine growth of tender grass, immense herds are sure to appear. How they discover that their table is spread we know not; it has been surmised that stragglers from the main body, who have wandered away when food became scarce, may first notice the new growth, and by some mysterious means communicate the good news to their hungry brethren. Monkeys also wander from land to land, when driven by hunger or fierce enemies; they have even been suspected of passing through a tunnel under the Straits of Gibraltar, from Africa to Europe. Their mode of crossing rivers is a beautiful evidence of their ingenuity and instinct. A powerful male seizes a branch that projects over the banks of the stream, and suspends himself by his prehensile tail; another takes hold of him, and so on until they have a row as long as the river is wide. Then they begin to swing the living chain, and continue until the impetus is powerful enough to enable the last one to take hold of a tree on the opposite shore. Over this strange bridge the whole host passes safely; as soon as they are across, the first monkey lets go his hold, the chain swings again, and so they all safely get over large rivers.

The so-called domestic animals travel exclusively by the agency of man and in his company. It is thus that the horse, a native of the rude steppes of Central Asia, which was not known in America before the arrival of the Spaniards, now roams over it in vast herds from Hudson Bay to Cape Horn. To man we owe it that the goat climbs our rocky mountains, and white, woolly sheep graze on scanty mountain-sides, whilst the heavier, slower cattle fatten on rich low grounds, and remind us, in the far backwoods, by the sweet harmonies of their bells, of the neighbourhood of men. But here, also, the weeds have come with the good plants. Thus the domestic rat, a native of the Old World, was carried in ships to the Cape, to Mauritius and Bourbon, to the Antilles and Bermuda. An Antwerp ship brought them in 1544 first to America, where they astonished the good Peruvians so much that they obtained with them the name of "things that came out of the sea." Now they are rarer in Europe than in America.

The importance of the useful domestic animals cannot be overrated. The very existence of man is bound up with the horse, the ox, and the sheep. Brazil lives almost exclusively by means of her horses and her cattle; and Australia has developed her resources and progressed in civilisation only since sheep have been introduced. It is strange, surely, that like all the best gifts in the vegetable world, (the cerealia,) so these domestic animals also are presents which the East has sent to the West, and for which no return has been made. Here, also, an invisible but insurmountable barrier seems to prevent such an exchange.

—*Putnam's Magazine.*

FROM "WINDSOR FOREST."

See from the brake the whirring pheasant springs,
And mounts exulting on triumphant wings:
Short is his joy, he feels the fiery wound,
Flutters in blood, and, panting, beats the ground.
Ah! what avail his glossy, varying dyes,
His purple crest, and scarlet-circled eyes,
The vivid green his shining plumes unfold,
His painted wings, and breast that flames with gold?
Nor yet, when moist Arcturus clouds the sky,
The woods and fields their pleasing toils deny.
To plains with well-breathed beagles we repair
And trace the mazes of the circling hare:
(Beasts, urged by us, their fellow beasts pursue,
And learn of man each other to undo,)
With slaughtering guns the unwearied fowler roves,
When frosts have whitened all the naked groves;
Where doves in flocks the leafless trees o'ershade,
And lonely woodcocks haunt the watery glade,
He lifts the tube and levels with his eye;
Straight a short thunder breaks the frozen sky:
Oft, as in airy rings they skim the heath,
The clamorous lapwings feel the leaden death:

Oft as the mounting larks their notes prepare,
They fall and leave their little lives in air.
In genial spring beneath the quivering shade,
Where cooling vapours breathe along the mead,
The patient fisher takes his silent stand,
Intent, his angle trembling in his hand;
With looks unmoved he hopes the scaly breed
And eyes the dancing cork and bending reed.
Our plenteous streams a various race supply,
The bright-eyed perch with fins of Tyrian dye,
The silver eel in shining volumes roll'd,
The yellow carp in scales bedropp'd with gold,
Swift trouts diversified with crimson stains,
And pikes, the tyrants of the watery plains.
Now Cancer glows with Phœbus' fiery car:
The youth rush eager to the silvan war,
Swarm o'er the lawns, the forest walks surround,
Rouse the fleet hart and cheer the opening hound.
The impatient courser pants in every vein,
And, pawing, seems to beat the distant plain:
Hills, vales, and floods appear already crossed,
And ere he starts, a thousand steps are lost.
See the bold youth strain up the threatening steep,
Rush through the thickets, down the valleys sweep,
Hang o'er their coursers' heads with eager speed,
And earth rolls back beneath the flying steed.
Let old Arcadia boast her ample plain,
The immortal huntress and her virgin train;
Nor envy, Windsor, since thy shades have seen
As bright a goddess and as chaste a queen;
Whose care, like hers, protects the silvan reign,
The earth's fair light, and empress of the main.

—POPE.

AN ELEPHANT HUNT.

WE entered a most beautiful valley, abounding in large game. Finding a buffalo lying down, I went to secure him for our food. Three balls did not kill him, and, as he turned round as if for a charge, we ran for the shelter of some rocks. Before we gained them we found that three elephants, probably attracted by the strange noise, had cut off our retreat on that side; they, however, turned short off, and allowed us to gain the rocks. We then saw that the buffalo was moving off quite briskly, and, in order not to be entirely baulked, I tried a long shot at the last of the elephants, and, to the great joy of my people, broke his fore leg. The young men soon brought him to a stand, and one shot in the brain despatched him. I was right glad to see the joy manifested at such an abundant supply of meat.

On the following day, while my men were cutting up the elephant, great numbers of the villagers came to enjoy the feast. We were on the side of a fine green valley, studded here and there with trees, and traversed by numerous rivulets. I had retired from the noise to take an observation among some rocks of laminated grit, when I beheld an elephant and her calf at the end of the valley, about two miles distant. The calf was rolling in the mud, and the dam was standing fanning herself with her great ears. As I looked at them through my glass, I saw a long string of my own men appearing on the other side of them, and Sekwebu came and told me that these had gone off saying, "Our father will see to-day what sort of men he has got." I then went higher up the side of the valley, in order to have a distinct view of their mode of hunting. The goodly beast, totally unconscious of the approach of an enemy, stood for some time suckling her young one, which seemed about two years old; they then went into a pit containing mud, and smeared themselves all over with it, the little one frisking about his dam, flapping his ears and tossing his trunk incessantly, in elephantine fashion. She kept flapping her ears and wagging her tail as if in the height of enjoyment. Then began the piping of her enemies, which was performed by blowing into a tube, or into the closed hands, as boys do into a key. They called out to attract the animal's attention. "O chief! chief! we have come to kill you. O chief! chief! many more will die besides you. The gods have said it," &c., &c.* Both animals expanded their ears and listened, then left their bath as the crowd rushed toward them. The little one ran toward the end of the valley, but, seeing the men there, returned to his dam. She placed herself on the danger side of her calf, and passed her proboscis over it again and again, as if to assure it of safety. She frequently looked back to the men, who kept up an incessant shouting, singing, and piping; then looked at her young one and ran after it sometimes sideways, as if her feelings were divided between anxiety to protect her offspring, and desire to punish the temerity of her persecutors. The men kept about a hundred yards in her rear, and some distance from her flanks, and continued thus until she was obliged to cross a rivulet. The time spent in descending and getting up the opposite bank allowed of their coming up to the edge, and discharging their spears at about twenty yards' distance. After the first discharge she appeared with her sides red with blood, and, beginning to flee for her own life, seemed to think no more of her young.

I had previously sent off Sekwebu with orders to spare the calf. It ran very fast, but neither young nor old ever enter into a gallop; their quickest pace is only a sharp walk. Before Sekwebu could reach them, the calf had taken refuge in the water, and was killed. The pace of the dam gradually became slower. She turned with a shriek of rage, and made a furious charge back among the men. They vanished at right angles to her course, or sideways; and as she ran straight on, she went through the whole party without coming near any one, except a man who wore a piece of cloth on his shoulders. Bright clothing is always dangerous in these cases. She charged three or four times, and, except in the first instance, never went farther than a hundred yards. She often stood after she had crossed a rivulet, and faced the men only to receive more spears. It was by this process of spearing and loss of blood that she was killed; for at last, making a short charge, she staggered round, and sank down dead in a kneeling posture. I turned from the spectacle of the destruction of noble animals, which might be made so useful in Africa, with a feeling of sickness; and it was not relieved by the recollection that the ivory was mine, though such was the case. I regretted to see them killed, and more especially the young one, the meat not being at all necessary at that time; but it is right to add that I did not feel sick when my own blood was up the day before.

—Dr Livingstone.

CLOTHING FROM ANIMALS—FUR, WOOL, SILK, LEATHER.

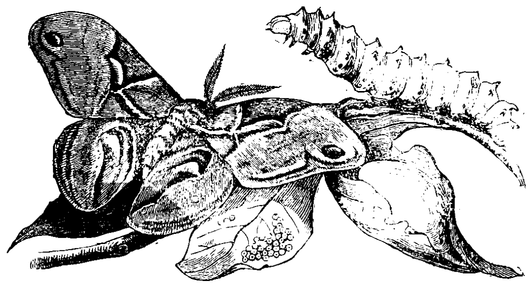
In the hide of an animal, the hair and skin are two entirely distinct things, and must be considered separately as materials for clothing. The hair of quadrupeds differs much in fineness. It is chiefly the smaller species which are provided with those soft, thick, glossy coverings that bear the name of *fur*, and they are found in the greatest perfection where they are most wanted, that is, in the coldest countries. They form indeed the riches of those dreary wastes which produce nothing else for human use. The animals most esteemed for their fur are of the weasel kind: the glutton, the marten, the sable, and the ermine. Fur is used either growing to the skin, or separated from it. In its detached state, it is usually employed in making a stuff called *felt*. The scales of hair are so disposed, that they make no resistance to the finger drawn along the hair from the root to the point, but cause a roughness and resistance in a contrary direction. From this property, hairs, when beaten or pressed together, are disposed to twist round each other, and thus to cohere into a mass. It is in the manufacture of hats that felting is chiefly practised; and the fur used for this purpose is that of the beaver, the rabbit, and the hare.

Wool differs from common hair in being more soft and supple, and more disposed to curl. These properties it owes to a degree of unctuosity, or greasiness, which is with difficulty separated from it. The whole wool, as taken from the animal's body, is called a *fleece*. The first operation this undergoes is that of picking and sorting into the different kinds of wool of which it is composed. These are next cleansed from marks and stains, and freed from their offensive greasiness. The wool is then delivered to the wool-comber, who, by means of iron-spiked combs, draws out the fibres, smooths and straightens them, separates the refuse, and brings it into a state fit for the spinner. The spinner forms the wool into threads, which are more or less twisted, according to the manufacture for which they are designed; the more twisted forming *worsted*, the looser *yarn*.

The kinds of stuffs made wholly or partly of wool are extremely various; and Great Britain produces more of them, and in general of better quality, than any other country. A more perfect manufacture than our broad cloths, with respect to beauty and utility, cannot easily be conceived. The threads in it are so concealed by a fine nap or down raised on the surface, and curiously smoothed and glossed, that it looks more like a rich texture of nature's forming, than the work of the weaver. Wool, in common with other animal substances, takes a dye better than any vegetable matters. Our cloths are therefore made of every hue that can be desired; but, in order to fit them for the dyer, they are first freed from all greasiness and foulness by the operation of *fulling*, in which the cloths are beaten by heavy mallets as they lie in water, with which a quantity of fuller's earth has been mixed. This earth unites with the greasy matter, and renders it soluble in water, so that, by continually supplying fresh streams while the beating is going on, all the foulness is at length carried off. The operation of fulling has the farther effect of thickening the cloth, and rendering it more firm and compact, by mixing the threads with each other, something in the manner of a felt. The cloths of inferior fineness are mostly called narrow cloths. Some of those used for greatcoats, by their substance and shagginess, resemble the original fleece, or rather the fur of a bear, and render unnecessary the use of furred garments. Indeed, with the single material of wool, art has been able much better to suit the different wants of man in his clothing, than can be done by all the productions of nature. What could be so comfortable for our beds as blankets? What so warm and at the same time so light, for pained and palsied limbs, as flannel? The several kinds of the worsted manufacture are excellent for that elasticity which makes them sit close to a part without impeding its motions. This quality is particularly observable in stockings made of worsted. Even the thinnest of the woollen fabrics possess a considerable degree of warmth, as appears in shawls. The real shawls are made of the fine wool of Thibet, in the eastern part of Asia; but they have been well imitated by the product of some of our English looms. A very different article made of wool, yet equally appropriated to luxury, is carpeting. Upon the whole, Dyer's praise of wool seems to have a just foundation :—

> "Still shall o'er all prevail the shepherd's stores,
> For numerous uses known : none yield such warmth,
> Such beauteous hues receive, so long endure :
> So pliant to the loom, so various,—none."

Men must have been far advanced in the observation of nature before they found out a material for clothing in the labours of a caterpillar. China appears to have been the first country to make use of the web spun by the *silkworm*. This creature, which, in its perfect state, is a kind of moth, is hatched from the egg, in the form



EGGS—COCOON—CHRYSALIS—CATERPILLAR.

of a caterpillar, and passes from that state successively to those of a chrysalis, and of a winged insect. While a caterpillar, it eats voraciously, its proper and favourite food being the leaves of the different species of mulberry. By this diet it is not only nourished, but is enabled to lay up, in receptacles within its body formed for the purpose, a kind of transparent glue, which has the property of hardening as soon as it comes into the air. When arrived at full maturity, it spins itself a web out of this gluey matter, within which it is to lie safe and concealed during its transformation into the helpless and motionless state of a chrysalis.

The silkworm's web is an oval ball, called a cocoon, of a hue varying from light straw colour to full yellow, and consisting of a single thread wound round and round, so as to make a close and impenetrable covering. The thread is so very fine, that, when unravelled, it has been measured to 700 or 1000 feet, all rolled within the compass of a pigeon's egg. In a state of nature, the silkworm makes its cocoon upon the mulberry tree itself, where it shines like a golden fruit among the leaves; and in the southern parts of China, and other warm countries of the East, it is still suffered to do so, the cocoons being gathered from the trees without farther trouble. But, in even the warmest climates of Europe, the inclemencies of the weather in spring, when the worms are hatched, will not permit the rearing them in the open air. They are kept, therefore, in warm but airy rooms, constructed for the purpose; and are regularly fed with mulberry-leaves till the period of their full growth.

As this tree is one of the latest in leafing, silkworms cannot advantageously be reared in cold climates. During their growth, they several times shed their skins, and many die under this operation. At length they become so full of the silky matter, that it gives them a yellowish tinge, and they cease to eat. Twigs are then presented to them upon little stages of wicker-work, on which they immediately begin to form their webs. When the cocoons are finished, a small number, reserved for breeding, are suffered to eat their way out in their butterfly state; the rest are killed in the chrysalis state, by exposing the cocoons to the heat of an oven.

The next business is to wind off the silk. After separating a downy matter from the outside of the cocoons, called *floss,* they are thrown into warm water; and the ends of the threads being found, several are joined together, and wound in a single one, upon a reel. This is the silk in its natural state, called *raw silk.* It next undergoes some operations to cleanse and render it more supple; after which it is made into what is called *organzine,* or *thrown silk,* being twisted into thread of such different degrees of fineness as are wanted in the different manufactures. This is done in the large way by mills of curious construction, which turn at once a vast number of spindles, and perform at the same time the processes of unwinding, twisting, reeling, &c. The largest and most complicated machine for this purpose, in England, is at Derby, the model of which was clandestinely brought from Italy, where all the branches of the silk manufacture have long flourished.

The excellence of silk, as a material for clothing, consists in its strength, lightness, lustre, and readiness in taking dyes. When little known in Europe, it was highly prized for its rarity; it is now esteemed for its real beauty and other valuable qualities. As it can never be produced in great abundance, it must always be a dear article of clothing. The fabrics of silk are very numerous, and almost all devoted to the purposes of show and luxury. In thickness they vary from the finest gauze to velvet, the pile of which renders it as close and warm as a fur. Some of the most beautiful of the silk manufactures are the glossy satin; the elegant damask, of which the flowers are of the same hue with the piece, and only show themselves from the difference of shade; the rich brocade, in which flowers of natural colours, or of gold and silver thread, are interwoven; and the infinitely varied ribands. It is also a common material for stockings, gloves, buttons, strings, &c., in which its durability almost compensates for its dearness. Much is used for the purpose of sewing, no other thread approaching it in strength.

Silk, in short, bears the same superiority among clothing materials that gold does among metals; it gives an appearance of richness wherever it is employed, and confers a real value. Even the refuse of silk is carefully collected, and serves for useful purposes. The down about the cocoons, and the waste separated in the operations raw silk undergoes, are spun into a coarser thread, of which very serviceable stockings are made; and the interior part of the cocoon is reckoned to be the best material for making artificial flowers.

Whilst the covering of the skins of animals thus affords a valuable material for clothing, the skin itself is not less useful. It requires, however, greater previous preparation. It is necessary to impregnate it with a matter capable of preserving it from putrefaction, and at the same time to keep it in a state of flexibility and suppleness. When this is effected, skin becomes *leather*,—a substance of the highest utility, as well in clothing as for numerous other purposes. The principal operation in the preparation of leather is called *tanning*.

The hide, taken off with due care by the skinner, is first thrown into a pit with water alone, in order to free it from dirt. After lying a day or two, it is placed upon a solid half-cylinder of stone, called a *beam*, where it is cleared of any adhering fat or flesh. It is then put into a pit containing a mixture of lime and water, in which it is kept about a fortnight. The intent of this is to swell and thicken the hide, and to loosen the hair. Being now replaced upon the beam, the hair is scaped off, and it is next committed to the *mastering-pit.* The contents of this are some animal dung (pigeons' is preferred) and water; and its operation is to reduce that thickening which the lime had given. After this is effected, it is again cleansed on the beam, and is then put into the proper tanning liquor, called the *ooze*, which is an infusion of coarsely-powdered oak-bark in water. The bark of the oak, as well as every other part of it, abounds in a strongly astringent matter; and it is the thorough impregnation with this which preserves the hide from decay or putrefaction. When at length it is thought to have imbibed enough of the astringent matter, the hide is taken out and hung upon a pole to drain, after which it is put upon a piece of wood with a convex surface, called a *horse*, on which it is stretched and kept smooth and even. Finally, it is taken to the *drying-house*, a covered building with apertures for the free admission of air; and it is there hung up till it becomes completely dry; and thus the process of tanning is finished.

From the tanner the hide or skin is consigned to the *currier*, whose art is farther necessary in order to make it perfect leather. He first soaks it thoroughly in water, and then places it upon a *beam*, made of hard wood, with one side sloping and polished. He lays it with the grain-side, or that on which the hair grew, inwards, and the flesh-side outwards. He then, with a broad two-edged knife, having a handle at each end, shaves or pares the hide on the latter side, till all its inequalities are removed, and it is reduced to the degree of thinness required for use. After this operation it is again put into water, then scoured and rubbed with a polished stone. It is next besmeared with a kind of oil procured from sheep or deer-skin, or made by boiling train-oil and tallow together, with a view to soften or supple it. A great part of its moisture is then evaporated by hanging it up in a drying-house for some days; and it is farther dried by exposure to the sun, or to the heat of a stove. It is then differently treated, according as it is meant to be blacked or stained, or not. Without entering into minute particulars, it is enough to observe, that the astringent principle with which the leather has been impregnated in the tanning renders nothing necessary except the application of a solution of vitriol of iron, at once to strike a good black. This is laid on with a brush, generally on the grain-side of the leather; and it afterwards undergoes the operation of giving it that roughness which is called the *grain*. This is performed by rubbing it in all directions with a fluted board. When leather is blackened on the flesh-side, the colour is given by a mixture of lampblack and oil.

It is in the manner above described that leather is prepared for the making of shoes and boots, which is one of the principal uses of this material; and certainly no other substance could so well unite strength and suppleness with the property of keeping out water. The hides principally used in the shoe-manufacture are those of neat-cattle, or the ox-kind. For the more delicate work, the skins of the goat, dog, seal, and some other animals, are employed.

—Dr Aikin.

THE PIED PIPER OF HAMELIN.

I.

Hamelin town's in Brunswick,
By famous Hanover city;
The river Weser, deep and wide,
Washes its wall on the southern side,
A pleasanter spot you never spied;
But when begins my ditty,
Almost five hundred years ago,
To see the townsfolk suffer so,
From vermin, was a pity.
Rats!

II.

They fought the dogs, and killed the cats,
And bit the babies in the cradles,
And ate the cheeses out of the vats,
And licked the soup from the cook's own ladles,
Split open the kegs of salted sprats,
Made nests inside men's Sunday hats,
And even spoiled the women's chats,
By drowning their speaking
With shrieking and squeaking,
In fifty different sharps and flats.

III.

At last the people, in a body,
To the Town Hall came flocking:
"'Tis clear," cried they, "our Mayor's a noddy;
And as for our corporation,—shocking
To think we buy gowns lined with ermine
For dolts that don't or won't determine
What's best to rid us of our vermin!
You hope, because you're old and obese,
To find in the furry civic robe ease?
Rouse up, sirs! give your brains a racking,
To find the remedy we're lacking;
Or, sure as fate, we'll send you packing!"
At this the Mayor and Corporation
Quaked with a mighty consternation.

IV.

An hour they sat in council.
  At length the Mayor broke silence:
"For a guilder I'd my ermine gown sell;
  I wish I were a mile hence!
It's easy to bid one rack one's brain.
I'm sure my poor head aches again,
I've scratched it so, and all in vain.
Oh for a trap, a trap, a trap!"
Just as he said this, what should hap,
At the chamber-door, but a gentle tap?
"Bless us," cried the Mayor, "what's that?"
(With the Corporation as he sat,
Looking little, though wondrous fat;
Nor brighter was his eye, nor moister
Than a too-long-opened oyster,
Save when at noon his paunch grew mutinous,
For a plate of turtle green and glutinous,)
"Only a scraping of shoes on the mat?
Anything like the sound of a rat
Makes my heart go pit-a-pat!"

V.

"Come in!" the Mayor cried, looking bigger:
And in did come the strangest figure.
His queer long coat from heel to head,
Was half of yellow, and half of red;
And he himself was tall and thin,
With sharp blue eyes, each like a pin;
And light loose hair, yet swarthy skin;
No tuft on cheek, nor beard on chin,
But lips where smiles went out and in.
There was no guessing his kith and kin!
And nobody could enough admire
The tall man and his quaint attire.
Quoth one: "It's as my great-grandsire,
Starting up at the trump of doom's tone,
Had walked this way from his painted tombstone."

VI.

He advanced to the council table:
And, "Please your honours," said he, "I'm able,

By means of a secret charm, to draw
  All creatures living beneath the sun,
  That creep, or swim, or fly, or run,
After me, so as you never saw!
And I chiefly use my charm
On creatures that do people harm:
The mole, and toad, and newt, and viper;
And people call me the Pied Piper."
(And here they noticed round his neck
  A scarf of red and yellow stripe,
To match with his coat of the self-same check;
  And at the scarf's end hung a pipe.
And his fingers, they noticed, were ever straying,
As if impatient to be playing
Upon this pipe, as low it dangled
Over his vesture so old-fangled.)
"Yet," said he, "poor piper as I am,
  In Tartary I freed the Cham,
Last June, from his huge swarms of gnats;
  I eased in Asia the Nizam
Of a monstrous brood of vampire bats;
  And as for what your brain bewilders,
If I can rid your town of rats,
  Will you give me a thousand guilders?"
"One? fifty thousand!"—was the exclamation
Of the astonished Mayor and Corporation.

VII.

Into the street the Piper stept,
  Smiling first a little smile,
As if he knew what magic slept
  In his quiet pipe the while;
Then, like a musical adept,
  To blow the pipe his lips he wrinkled,
  And green and blue his sharp eyes twinkled,
  Like a candle-flame where salt is sprinkled;
And ere three shrill notes the pipe uttered,
You heard as if an army muttered;
And the muttering grew to grumbling;
And the grumbling grew to a mighty rumbling;
And out of the houses the rats came tumbling.

Great rats, small rats, lean rats, brawny rats,
Brown rats, black rats, gray rats, tawny rats,
Grave old plodders, gay young friskers,
Fathers, mothers, uncles, cousins,
Cocking tails and pricking whiskers;
Families by tens and dozens,
Brothers, sisters, husbands, wives,
Followed the Piper for their lives.
From street to street he piped advancing,
And step for step they followed dancing,
Until they came to the river Weser,
Wherein all plunged and perished;
Save one, who, stout as Julius Cæsar,
Swam across, and lived to carry
(As he the manuscript he cherished)
To Rat-land home his commentary,
Which was, "At the first shrill notes of the pipe,
I heard a sound as of scraping tripe,
And putting apples, wondrous ripe,
Into a cider-press's gripe:
And a moving away of pickle-tub-boards,
And a leaving ajar of conserve cupboards,
And a drawing the corks of train-oil flasks,
And a breaking the hoops of butter casks;
And it seemed as if a voice
(Sweeter far than by harp or by psaltery
Is breathed) called out, O rats, rejoice!
The world is grown to one vast drysaltery!
So munch on, crunch on, take your nuncion,
Breakfast, supper, dinner, luncheon!
And just as a bulky sugar puncheon,
All ready staved, like a great sun shone
Glorious, scarce an inch before me,
Just as, methought, it said, 'Come, bore me!'
I found the Weser rolling o'er me."

VIII.

You should have heard the Hamelin people
Ringing the bells till they rock'd the steeple:
"Go," cried the Mayor, "and get long poles!
Poke out the nests, and block up the holes!

Consult with carpenters and builders,
And leave in our town not even a trace
Of the rats!" When suddenly up the face
Of the Piper perked in the market-place,
With a "First, if you please, my thousand guilders!"

IX.

A thousand guilders! The Mayor looked blue;
So did the Corporation, too.
For Council dinners made rare havoc
With claret, moselle, vin-de-grave, hock;
And half the money would replenish
Their cellar's biggest butt with Rhenish.
To pay this sum to a wandering fellow
With a gipsy coat of red and yellow!
"Beside," quoth the Mayor, with a knowing wink,
"Our business was done at the river's brink;
We saw with our eyes the vermin sink,
And what's dead can't come to life, I think.
So, friend, we're not the folks to shrink
From the duty of giving you something to drink,
And a matter of money to put in your poke;
But as for the guilders, what we spoke
Of them, as you very well know, was in joke.
Besides our losses have made us thrifty:
A thousand guilders! Come, take fifty!"

X.

The Piper's face fell, and he cried,
"No trifling! I can't wait, beside!
I've promised to visit by dinner-time
Bagdad, and accept the prime
Of the head-cook's pottage, all he's rich in,
For having left, in the Caliph's kitchen,
Of a nest of scorpions no survivor.
With him I proved no bargain driver—
With you, don't think I'll bate a stiver!
And folks who put me in a passion
May find me pipe to another fashion."

XI.

"How!" cried the Mayor, "d'ye think I'll brook
Being worse treated than a cook?
Insulted by a lazy ribald,
With idle pipe and vesture piebald?
You threaten us, fellow? Do your worst—
Blow your pipe there till you burst!"

XII.

Once more he stepped into the street;
And to his lips again
Laid his long pipe of smooth straight cane;
And ere he blew three notes (such sweet,
Soft notes as yet musician's cunning
Never gave the enraptured air)
There was a rustling, that seemed like a bustling
Of merry crowds justling, at pitching and hustling;
Small feet were pattering, wooden shoes clattering,
Little hands clapping, and little tongues chattering,
And like fowls in a farm-yard when barley is scattering,
Out came the children running.
All the little boys and girls,
With rosy cheeks and flaxen curls,
And sparkling eyes and teeth like pearls,
Tripping and skipping, ran merrily after
The wonderful music, with shouting and laughter.

XIII.

The Mayor was dumb, and the Council stood
As if they were changed into blocks of wood,
Unable to move a step, or cry
To the children merrily skipping by;
And could only follow with the eye
That joyous crowd at the Piper's back.
But how the Mayor was on the rack,
And the wretched Council's bosoms beat,
As the Piper turned from the High Street
To where the Weser rolled its waters
Right in the way of their sons and daughters!
However he turned from south to west,
And to Koppelberg hill his steps addressed,

And after him the children pressed:
Great was the joy in every breast.
"He never can cross that mighty top!
He 's forced to let the piping drop,
And we shall see our children stop!"
When, lo! as they reached the mountain's side,
A wondrous portal opened wide,
As if a cavern was suddenly hollowed!
And the Piper advanced, and the children followed.
And when all were in to the very last,
The door in the mountain-side shut fast.
Did I say all? No! one was lame,
And could not dance the whole of the way;
And in after years, if you would blame
His sadness, he was used to say:
"It 's dull in our town since my playmates left;
I can't forget that I 'm bereft
Of all the pleasant sights they see,
Which the Piper also promised me;
For he led us, he said, to a joyous land,
Joining the town, and just at hand,
Where waters gushed and fruit-trees grew,
And flowers put forth a fairer hue,
And everything was strange and new:
The sparrows were brighter than peacocks here,
And their dogs outran our fallow-deer,
And honey-bees had lost their stings,
And horses were born with eagles' wings;
And just as I became assured
My lame foot would be speedily cured,
The music stopped, and I stood still,
And found myself outside the hill,
Left alone against my will,
To go on limping as before,
And never hear of that country more!"

XIV.

Alas, alas! for Hamelin!
There came into many a burgher's pate
A text which says that heaven's gate
Opes to the rich at as easy rate

As the needle's eye takes a camel in!
The Mayor sent east, west, north, and south,
To offer the Piper by word or mouth,
  Wherever it was men's lot to find him,
Silver and gold to his heart's content,
If he 'd only return the way he went,
  And bring the children behind him.
But when they saw 'twas a lost endeavour,
And piper and dancers were gone for ever,
They made a decree that lawyers never
  Should think their records dated duly,
If, after the day of the month and year,
These words did not as well appear:
  "And so long after what happened here
  On the twenty-second of *Ju*ly,
  Thirteen hundred and seventy-six:"
And the better in memory to fix
The place of the children's last retreat,
They called it the Pied Piper's Street—
Where any one playing on pipe or tabor
Was sure for the future to lose his labour.
Nor suffered they hostelry or tavern
  To shock with mirth a street so solemn;
But opposite the place of the cavern
  They wrote the story on a column;
And on the great church window painted
The same to make the world acquainted
How their children were stolen away;
And there it stands to this very day.
And I must not omit to say
That in Transylvania there 's a tribe
Of alien people, that ascribe
The outlandish ways and dress,
On which their neighbours lay such stress,
To their fathers and mothers having risen
Out of some subterraneous prison,
Into which they were trepanned
Long time ago, in a mighty band,
Out of Hamelin town in Brunswick land,
But how or why they don't understand.

XV.

So, Willy, let you and me be wipers
Of scores ont with all men—especially pipers;
And whether they pipe us free from rats or from mice,
If we 've promised them aught, let us keep our promise.
—ROBERT BROWNING.

THE PASSENGER PIGEON.

ONE of their curious roosting places on the banks of the Green River in Kentucky I repeatedly visited. It was, as is always the case, a portion of the forest where the trees are of great magnitude, and where there was little underwood. I rode through it upwards of forty miles, and found its average breadth to be rather more than three miles. My first view of it was about a fortnight subsequent to the period when they had made choice of it, and I arrived there nearly two hours before sunset.

Few pigeons were then to be seen, but a great number of persons with horses and waggons, guns and ammunition, had already established encampments on the borders. Two farmers from the vicinity of Russelsville, distant more than a hundred miles, had driven upwards of three hundred hogs to be fattened on the pigeons that were to be slaughtered. Here and there the people employed in plucking and salting what had already been procured, were seen sitting in the midst of large piles of these birds. Many trees, two feet in diameter I observed, were broken off at no great distance from the ground; and the branches of many of the largest and tallest had given way, as if the forest had been swept by a tornado. Everything proved to me that the number of birds resorting to this part of the forest must be immense beyond conception. As the period of their arrival approached, their foes anxiously prepared to receive them; some were furnished with iron pots containing sulphur—others with torches of pine-knots,—many with poles, and the rest with guns. The sun was lost to our view, yet not a pigeon had arrived. Everything was ready, and all eyes were gazing on the clear sky which appeared in glimpses amidst the tall trees.

Suddenly there burst forth a general cry, "Here they come."

The noise which they made, though yet distant, reminded me of a hard gale at sea, passing through the rigging of a close reefed vessel. As the birds arrived and passed over me, I felt a current of air that surprised me. Thousands were soon knocked down by the pole-men; the birds continued to pour in; the fires were lighted, and a most magnificent as well as wonderful and almost terrifying sight presented itself. The pigeons, arriving by thousands, alighted everywhere, one above another, until solid masses as large as hogsheads were formed on the branches all round. Here and there the perches gave way with a crash, and, falling on the ground, destroyed hundreds of the birds beneath, forcing down the dense groups with which every stick was loaded.

It was a scene of uproar and confusion; no one dared venture within the line of devastation; the hogs had been penned up in due time, the picking up of the dead and wounded being left for next morning's employment. The pigeons were constantly coming, and it was past midnight before I perceived a decrease in the number of those that arrived. Toward the approach of day, the noise in some measure subsided; long before objects were distinguishable, the pigeons began to move off in a direction quite different from that in which they had arrived the evening before, and at sunrise all that were able to fly had disappeared. The howlings of the wolves now reached our ears, and the foxes, lynxes, cougars, bears, racoons, and opossums were seen sneaking off, whilst eagles and hawks of different species, accompanied by a crowd of vultures, came to supplant them, and enjoy their share of the spoil.

—AUDUBON.

TO A WATERFOWL.

WHITHER, midst falling dew,
While glow the heavens with the last steps of day,
Far through their rosy depths dost thou pursue
Thy solitary way?

Vainly the fowler's eye
Might mark thy distant flight to do thee wrong,
As, darkly painted on the crimson sky,
Thy figure floats along.

Seek'st thou the plashy brink
Of weedy lake, or marge of river wide,
Or where the rocking billows rise and sink
On the chafed ocean-side?

There is a power whose care
Teaches thy way along that pathless coast,—
The desert and illimitable air,—
Lone wandering, but not lost.

All day thy wings have fanned,
At that far height, the cold, thin atmosphere:
Yet stoop not, weary, to the welcome land,
Though the dark night is near.

And soon that toil shall end;
So shalt thou find a summer home, and rest,
And scream among thy fellows; reeds shall bend
Soon o'er thy sheltered nest.

Thou 'rt gone;—the abyss of heaven
Hath swallowed up thy form: yet on my heart
Deeply hath sunk the lesson thou hast given,
And shall not soon depart.

He, who from zone to zone,
Guides through the boundless sky thy certain flight,
In the long way that I must tread alone,
Will lead my steps aright.

—BRYANT.

THE CHEQUERED SNAKE.

Charles. There is a snake crossing the road. Are there many species of snakes found in this country?

Father. I have never seen any but this species, the common chequered snake, but it is possible there may be more.*

C. Is it venomous?

F. No, perfectly harmless; as I have proved by examining the mouth: all venomous serpents have two or more large curved fangs in the upper jaw, which are wanting in harmless ones. "In general it may be said that innocent serpents have four rows of teeth in the upper jaw; two on the palate, and one on each side; but that poisonous serpents have no other outward or side-teeth but the fangs." When attacked, this snake, l ke many other harmless kinds, rears itself up in a threatening attitude, dilates its body, brightens its colours, and darts in and out and vibrates its red, forked tongue: this organ, called by the vulgar, "its sting," and supposed to be the weapon of offence, is considered an undoubted token of its venomous nature. But in reality, all these motions are but menaces; there is no power to do hurt, though they no doubt often serve as a protection. In common with the whole serpent race, it is the object of universal enmity: every person seems to consider it a sort of duty to kill snakes whenever they can be met with, perhaps in consequence of the curse entailed on the serpent that beguiled Eve.

C. The snake becomes torpid during winter, I believe.

* More than possible; over twelve species are found in many parts of Canada.

F. Yes; it conceals itself in the fall, in some convenient spot, such as under logs, often in heaps of stones, and sometimes, I have reason to think, in the earth; for in ploughing late in the autumn, I once turned up a chequered snake; it was inert and dull, but not torpid.

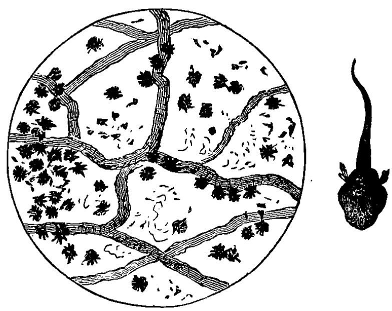
C. At what period of the year does it cast its skin?

F. I believe that is the first operation performed, after its revivification in spring, and before it leaves its winter concealment. An intelligent neighbour informed me that once in turning over a heap of stones early in spring, before the snow had all disappeared, he discovered a snake in the very act of sloughing its skin; the skin was stripped off from the head to about the middle of the body; the displaced part lay around it in close folds or wrinkles; even the eyes were skinned. If I recollect aright, in Bingley's "Animal Biography," it is intimated that the snake crawls among the stalks of plants, in order that the skin may be rubbed off by friction, and that it is turned inside out, as we draw off a stocking. My neighbour's account appears far more probable; besides, it is supported by analogy, for it is exactly the mode in which all caterpillars slough their skins, as I have many times witnessed. The food of the snake is frogs, toads, lizards, and probably insects. I once killed a snake which I found in the field, (supposing then that it was poisonous,) by dashing it against the ground; and something protruded which I supposed was its bowels, but on examination, I found it to be the pretty olive-spotted frog, with an orange-coloured belly; it, too, was torn, but whether this was done by the snake, or by the shock against the ground, I don't know; I suspect the latter, and that it had been swallowed whole, and probably alive. A friend of mine informed me that he once saw a snake of unusually large size, and determined to kill and open it, which he accordingly did, and found a very large green frog, which was dead of course, but unbroken. It seems impossible that so slender an animal as a snake can swallow or contain so large a creature as a frog, but the jaws, throat, and body, are capable of prodigious distension.

C. I have read that the sloughs of snakes are an object of superstition with some Indian tribes, and are used in their pretended magical rites.

F. They are also an indispensable article in the nests of some birds; perhaps from their softness, as they are extremely thin and smooth.

—Gosse's *Canadian Naturalist.*



THE TAIL OF A TADPOLE.

A BLADE of grass is a world of mystery, " would men observingly distil it out." When my erudite friend, Dr Syntax, glancing round my workroom, arrested his contemptuous eye on a vase abounding in tadpoles, and asked me with a sniffing superiority: " Do you really mean to say you find any interest in these little beasts?" I energetically answered, " As much as you find in books." " Hem," grunted Syntax.

" Very absurd, isn't it? But we have all our hobbies. I can pass a bookstall, on which I perceive that the ignorance of the bookseller permits him to exhibit an edition of Persius among the rubbish at 'one shilling each.' The sight gives me no thrill—it does not even slacken my rapid pace. But I can't so easily pass a pond in which I see a shoal of tadpoles swimming about, as ignorant of their own value as the bookseller is of Persius. I may walk on, but the sight has sent a slight electric shock through me. Why, sir, there is more to me in the tail of one of those tadpoles than in all the poems of that obscure and dreary Persius. But I won't thrash your Jew unless you thrash mine."

" Why, what on earth can you do with the tail?"

" Do with it? Study it—experiment on it—put it under the microscope, and day by day watch the growth of its various parts. At first it is little but a mass of cells. Then I observe some of these cells assuming a well-known shape, and forming rudimentary blood-vessels. I also observe some other cells changing into blood-cells. Then the trace of muscles becomes visible. These grow and grow, and the pigment-cells, which give their colour to the tail, assume fantastic shapes."

"Very interesting, I dare say."

"You don't seem to think so by your tone. But look in this vase:—Here are several tadpoles with the most apologetic of tails; mere stumps, in fact. I cut them off nine days ago."

"Will they grow again?"

"Perfectly; because, although the frog dispenses with a tail, and gradually loses it by resorption, (drawing in by suction,) as he reaches the frog form, the tadpole needs his tail to swim with; and Nature kindly supplies any accident that may deprive him of it."

"Yes, yes," added Syntax, glad to feel himself once more in the region of things familiarly known; "just like the lobster or the crab, you know. They tear off their legs and arms in the most reckless manner, yet always grow them again."

"Would you like to know what has become of these tails?"

"Arn't they dead?"

"Not at all. Alive and kicking."

"Alive after nine days? Oh! oh!"

"Here they are in this glass. It is exactly nine days since they were cut off, and I have been watching them daily under the microscope. I assure you that I have seen them grow, not *larger*, indeed, but *develop* more and more, muscle-fibres appearing where no trace of fibre existed."

"Come, now, you are trying my gullibility!"

"I am perfectly serious. The discovery is none of mine. It was made by M. Vulpian in Paris. He says that the tails constantly live many days—as many as eighteen on one occasion; but I have never kept mine alive more than eleven. He says, moreover, that they not only grow, as I have said, but manifest sensibility, for they twist about with a rapid swimming movement when irritated. I have not seen this, but M. Vulpian is too experienced a physiologist to have been mistaken; and with regard to the growth of the tails, his observations are all the more trustworthy, because he daily made drawings of the aspect presented by the tails, and could thus compare the progress made."

"Well, but I say, how *could* they live when separated from the body? Our arms or legs don't live; the lobster's legs don't live."

"Quite true; but in these cases we have limbs of a complex organisation, which require a complex apparatus for their maintenance; they must have blood, the blood must circulate, the blood must be oxygenated."

"Stop, stop; I don't want to understand why our arms can't live apart from our bodies. They *don't*. The fact is enough for me. I want to know why the tail of a tadpole can live apart from the body."

"It *can*. Is not the fact enough for you in that case also? Well, I was going to tell you the reason. The tail will only live apart from the body so long as it retains its early immature form; that is to say, so long as it has not become highly organised. If you cut it off from a tadpole which is old enough to have lost its external gills a week or more, the tail will not live more than three or four days. And every tail will die as soon as it reaches the point in its development, which requires the circulation of the blood as a necessary condition."

"But where does it get food?"

"That is more than I can say. I don't know that it wants food. The power of abstinence of reptiles is amazing."

"Really I begin to think there is more in these little beasts than I suspected. But you see it requires a deal of study to get at these things."

"Not more than to get at any of the other open secrets of nature. But since you are interested, look at these tails as the tadpoles came bobbing against the side of the glass. Do you see how they are covered with little white spots?"

"No."

"Look closer. All over the tail there are tiny cotton-like spots. Take a lens, if your unaccustomed eye isn't sharp enough. There, now you see them."

"Yes; I see a sort of *fluff* scattered about."

"That fluff is an immense colony of parasites. Let us place the tadpole under the microscope, and you will see each spot turn out to be a multitude of elegant and active animals, having bodies not unlike a crystal goblet supported on an extremely long and flexible stem, and having round their *rim*, or mouth, a range of long delicate hairs, the incessant motion of which gives a wheel-like aspect, and makes an eddy in the water which brings food to the animal."

"Upon my word, this is really interesting! How active they are! How they shrink up, and then, unwinding their twisted stems, expand again! What's the name of this thing?"

"*Vorticella*. It may be found growing on water-fleas, plants, decayed wood, or these tadpoles. People who study the animalcules are very fond of this vorticella."

"Well, I never could have believed such a patch of fluff could turn out a sight like this; I could watch it for an hour. But what are those small yellowish things sticking on the side of these parasites?"

"Those, my dear Syntax, are also parasites."

"What! parasites living on parasites?"

"Why not? Nature is economical. Don't you live on beef, and mutton and fish? Don't these beefs, muttons, and fish, live on vegetables and animals? Don't these vegetables and animals live on other organic matters? Eat and be eaten is one law: live and let live is another."

The learned doctor remained thoughtful; then he screwed up one side of his face into frightful contortions, as with the eye of the other he resumed his observations of the vorticella.

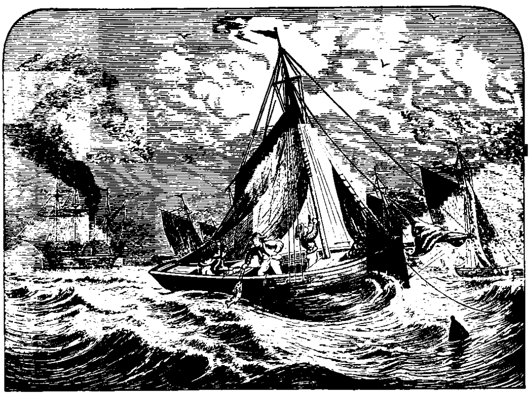
—G. H. Lewes.

THE NEWFOUNDLAND FISHERIES.

The banks of Newfoundland, the most extensive submarine elevation on the globe, in their full extent occupy 16 degrees of longitude, and nearly 10 degrees of latitude; they are between 600 and 700 miles in length; the depth of water on them varies from 4 to 160 fathoms. The temperature of the water on the Great Bank is 10 or 12 degrees lower than in the surrounding ocean.

The outer bank, also called the False Bank, extends from 44° 10′ to 47° 30′ N. lat., and from 44° 15′ to 45° 25′ W. long. The Great Bank, which lies 2½° west of the False Bank, occupies more than 9° of latitude and 5° of longitude. Whale Bank, Green Bank, and St Peter's Bank, to the south of the island, are of much smaller dimensions.

Cod-fish is found on the Great Bank in the greatest abundance; but there are so many disadvantages attending the fishing-ground, as compared with the harbours and shores of the island, that bank-fishing has of late years been much neglected by the English, although it is still prosecuted by the American and French fishermen. The bank is covered by continual fogs; rain and sleet are also frequent, and in the early part of the season much inconvenience is experienced from ice. Besides avoiding these inconveniences, the fishermen who remain near to the shore have better opportunities for curing and drying their fish, the quality of which is therefore preferred.



FISHING ON THE BANKS.

The following description is by Lieutenant Chappell, R.N.:— "There are a number of boats fitted with masts and sails belonging to each fishery, two or four men being stationed to a boat. At the earliest dawn of day the whole of these vessels proceed to that part of the coast where the cod are most plentiful, for they move in shoals, and frequently alter their position, according to the changes of the wind. When the resort of the fish has been ascertained, the boats let fall their anchors, and the men cast over their lines. Each man has two lines to attend, and every line has two hooks affixed to it, which are baited either with caplin (*a small fish swarming upon the banks*) or herrings. The men stand upon a flat flooring, and are divided from each other by bins, like shop-counters, placed athwart the centre of the boat. Having drawn up the line, they lay the cod upon the bin, and strike it upon the back part of the head with a piece of wood in the shape of a rolling-pin; this blow stuns the fish, and causes it to yawn its jaws widely asunder, by which means the hook is easily extracted. Then the fish is dropped into the bin and the line again thrown over, whilst the fisherman, instantly turning round, proceeds to pull up the opposite line, so that one line is running out and the other pulling in at the same instant. Thus the boatmen continue until their vessel is filled, when they proceed to discharge their cargo at the fishing-stage. The cod are pitched from the boat upon the stage with a pike, care being taken to stick the pike into their heads, as a wound in the body might prevent the salt from having its due effect, and thereby spoil the fish. When the boats are emptied, the fishermen procure a fresh quantity of bait, and return again to their employment on the water, whence, in the course of an hour or two, perhaps, they again reach the stage with another cargo."

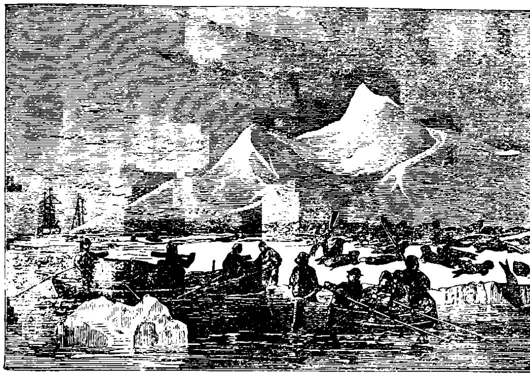
The curing is managed as follows :—

"Each salting-house is provided with one or more tables, around which are placed wooden chairs and leathern aprons for the cut-throats, headers, and splitters. The fish having been thrown from the boats, a boy is generally employed to bring them on the stage, and place them on the table before the cut-throat, who rips open the bowels; and having also nearly severed the head from the body, he passes it along the table to his right-hand neighbour, the header, whose business it is to pull off the head and tear out the entrails; from these he selects the liver, and in some instances the sound. The head and entrails being precipitated through a bunk into the sea, the liver is thrown into a cask, where it distils in oil; and the sounds, if intended for preservation, are salted. After having undergone this operation, the cod is next passed across the table to the splitter, who cuts out the backbone, as low as the navel, in the twinkling of an eye. From hence the cod are carried in hand-barrows to the salter, by whom they are spread in layers upon the top of each other, with a proper quantity of salt between each layer. In this state the fish continue for a few days, when they are again taken in barrows to a stout wooden box full of holes, which is suspended from the stage in the sea. The washer stands up to his knees in this box and scrubs the salt off the cod with a soft mop. The fish are then taken to a convenient spot and piled up to drain, and the heap thus formed is called a 'water-horse.' On the following day the cod are removed to the fish-flakes, where they are spread in the sun to dry; and from thenceforward they are kept constantly turned during the day, and piled up in small heaps, called 'flackets,' at night. The upper fish are always laid with their bellies downward, so that the skins of their backs answer the purpose of thatch to keep the lower fish dry. By degrees the size of these flackets is increased, until at length, instead of small parcels, they assume the form of large circular stacks, and in this state the cod are left for a few days, as the fishermen say, 'to sweat.' The process of curing is now complete, and the fish are afterwards stored up in warehouses, lying ready for exportation.

"With such amazing celerity is the operation of heading, splitting, and salting performed, that it is not an unusual thing to see ten codfish decapitated, their entrails thrown into the sea, and their backbones torn out, in the short space of one minute and a half. The splitter receives the highest wages, and holds a rank next to the master of a fishery; but the salter is also a person of great consideration, upon whose skill the chief preservation of the cod depends.

"There are three qualities of cured cod-fish in Newfoundland. They are distinguished by the different titles of *merchantable fish*, those of the largest size, best colour, and altogether finest quality; *Madeira fish*, which are nearly as valuable as the former; this sort is chiefly exported to supply the Spanish and Portuguese markets; *West India fish*, the refuse of the whole. These last are invariably sent for sale to feed the negroes of the Caribbee Islands."

The cod-fishery does not commence until the 10th of June; previous to which the hardy Newfoundland fishermen occupy themselves in the seal-fishery. The 17th of March is the day fixed for the departure of the vessels employed in this business. At this time the harbours are frozen, and it is necessary for the crews to cut a channel through the ice sufficiently wide for the passage of the vessels, which are usually schooners of from 40 to 70 tons, or decked boats of from 25 to 35 tons' burthen, very strongly built, and fortified against the pressure of the ice by strong poles suspended over their sides. The crews of the larger vessels usually consist of from thirteen to eighteen men, who are all partners in the expedition, receiving a certain proportion of the vessel's earnings at the conclusion of the fishing. When a channel has been cut to the sea, the vessels make their way to the field-ice, pushing through the opening which it presents until they meet with a herd of seals, or what is whimsically called a seal-meadow. The hunters contrive, if possible, to surprise the seals while sleeping in the sun. When thus enabled to approach their prey, the men strike them on the nose with a bludgeon, which speedily kills them. The practice of shooting seals is not willingly resorted to, as the skin is thus likely to be injured. The skins are stripped off, together with the fat, and conveyed to the vessels,



SEAL-FISHING IN NEWFOUNDLAND.

where they are packed away in the hold. When the vessels are thus loaded, they return to port and dispose of their cargoes to the merchants. If they are successful, the vessels are generally able to make a second trip before the melting of the ice.

The merchant separates the fat or blubber from the skin. This fat is cut into small pieces and thrown into vats, which are exposed to the heat of the sun. In three or four weeks the oil will have separated itself. A small quantity of inferior oil is then procured by boiling the blubber. The oil which separates without the aid of fire is of a pale colour, and is frequently used for the adulteration of sperm-oil, its price being much lower. The boiled oil, being partially burnt, is of a dark colour, and cannot well be used for this purpose. When the fat has been removed, the skins are carefully stretched and laid up in piles with layers of salt between. They are shipped in bundles of five skins each for the convenience of stowage.

—*Geography of America.*

SUMMER LONGINGS.

AH! my heart is weary waiting,
  Waiting for the May—
Waiting for the pleasant rambles,
Where the fragrant hawthorn brambles,
  With the woodbine alternating,
  Scent the dewy way.
Ah! my heart is weary waiting,
  Waiting for the May.

Ah! my heart is sick with longing,
  Longing for the May—
Longing to escape from study,
To the young face fair and ruddy,
  And the thousand charms belonging
  To the summer's day.
Ah! my heart is sick with longing,
  Longing for the May.

Ah! my heart is sore with sighing,
  Sighing for the May—
Sighing for their sure returning,
When the summer beams are burning,
  Hopes and flowers that dead or dying,
  All the winter lay.
Ah! my heart is sore with sighing,
  Sighing for the May.

Ah! my heart is pained with throbbing,
  Throbbing for the May—
Throbbing for the sea-side billows,
Or the water-wooing willows;
  Where in laughing and in sobbing,
  Glide the streams away.
Ah! my heart, my heart is throbbing,
  Throbbing for the May.

Waiting sad, dejected, weary,
  Waiting for the May.
Spring goes by with wasted warnings—
Moon-lit evenings, sun-bright mornings—

Summer comes, yet dark and dreary
Life still ebbs away;
Man is ever weary, weary,
Waiting for the May!

—*Anon.*

AMERICAN INSECTS.

There are few among the insect tribes of Europe capable of producing sounds of any volume. The hum of bees and wasps, the buzzing of innumerable small flies, the piping of the gnat, the chirp of the grasshopper, the cry of the cricket, the tick of the death-watch—are the greater number of those an Englishman would enumerate. In southern Europe sounds are added sharper, louder, and more incessant; and I remember having been both amused and astonished, by the effect produced by the mole-crickets of France and the Jura, and yet more by the *cicada* of Italy, as, sitting among the thick foliage of the Roman pine, they would fill the ear of the panting traveller for minutes before he reached the place of their luxurious enjoyment.

But what are these scattered and solitary sounds, to the din which fills the ear at certain times and seasons from the insect tribes in the Transatlantic forest or swamp? The main agents in its production are, nevertheless, members of the same families of Gryllus and Cicada. The latter consists of many species, and affords some of the most laborious and successful musicians among the insect tribes. Every traveller has dilated upon the singular effect produced by one of them called the Catydid, as, sitting in little coteries among the trees, they fill the ear of night with their sharp and incessant wrangling; and my notice regards at present one of the same family.

When we returned from Mexico to the United States, in the summer of last year, 1834, among many points of interest, political, domestic, and foreign, which our re-entrance into the high-road of civilisation brought to our ears, was the fact that this was the "locust year."

The observation of a past century had shown the inhabitants of Pennsylvania and Maryland, that every seventeenth year they were visited by a countless horde of insects of the Cicada tribe, hence called *Septendecim*, distinct in aspect and habits from those whose annual appearance and mode of life were understood. Though of a different tribe, and with perfectly different habits from the locust of the East, the fact of its occasional appearance, as though by magic, in such vast swarms, had caused it to be familiarly alluded to by that name. Its last appearance had been in 1817, and its re-appearance was thus confidently predicted for the third or fourth week in May this year. (1834.)

Nature, true to her impulses, and the laws by which she is so mysteriously governed, did not fail to fulfil the prediction. On the 24th of May, and following day, the whole surface of the country in and about the city of Philadelphia, suddenly teemed with this singular insect. The subject interested me, and as during these days I had every opportunity of being daily, I may say hourly, attentive to the phenomena connected with it, both here and in Maryland, I send you the result of my observations.

The first day of their appearance, their numbers were comparatively few,—the second, they came by myriads; and yet a day or two might pass before they reached their full number. I happened to be abroad the bright sunny morning which might be called the day of their birth. At early morning, the insect, in the pupa state, may be observed issuing from the earth in every direction, by the help of a set of strongly barbed claws on the forelegs. Its colour is then of a uniform dull brown, and it strongly resembles the perfect insect in form, excepting the absence of wings, ornament, and antennæ. The first impulse of the imperfect insect, on detaching itself from its grave, is to ascend a few inches, or even feet, up the trunks of trees, at the foot of which their holes appear in the greatest number; or upon the rail-fences, which are soon thickly sprinkled with them. In these positions they straightway fix themselves firmly by their barbed claws. Half-an-hour's observation will then show you the next change which is to be undergone. A split takes place upon the shell, down from the back of the head to the commencement of the rings of the abdomen, and the labour of self-extrication follows. With many a throe and many a strain, you see the tail and hind-legs appear through the rent, then the wings extricate themselves painfully from a little case in the outer shell, in which they lie exquisitely folded up, but do not yet unfurl themselves; and, lastly, the head, with its antennæ, disengages itself, and you behold before you the new-born insect freed from its prison. The slough is not disengaged, but remains firmly fixed in the fibres of the wood; and the insect, languidly crawling a few inches, remains as it were in a dose of wonder and astonishment. It is rather under an inch in length, and appears humid and tender; the colours are dull, the eye glazed, the legs feeble, and the wings for a while after they are opened, appear crumpled and unelastic. All this passes before the sun has gained his full strength. As the day advances, the colours of the insect become more lively: the wings attain their full stretch, and the body dries and is braced up for its future little life of activity and enjoyment.

Between ten and eleven, the newly-risen tribes begin to tune their instruments; you become conscious of a sound, filling the air far and wide, different from the ordinary ones which may meet your ear. A low distinct hum salutes you, turn where you will. It may be compared to the simmering of an enormous cauldron,—it swells, imperceptibly changes its character, and becomes fuller and sharper—thousands seem to join in, and by an hour after mid-day, the whole country far and wide rings with the unwonted sound. The insects are now seen lodged in or flying about the foliage above: a few hours having been thus sufficient to give them full strength and activity, and bring them into full voice.

Well may the school-boy and the young curly-headed negro rejoice at the sound, for their hands will never want a plaything for many days to come. Well may the birds of the forest rejoice, for this is the season of plenty for them—the pigs and poultry too, they fatten on the innumerable swarms which, before many days, will cover the ground in the decline of their strength.

The pretty insect, for it is truly such, with its dark body, red eyes, and its glassy wings interlaced by bright yellow fibres—enjoys but a little week; and that merry harping which pervades creation from sunrise to sundown, for the time of its continuance, is but of some six days' duration. Its character would be almost impossible to describe, though it rings in my ears every time I think of the insect. Like all those of its tribe, the sound produced is not a voice, but a strong vibration of musical chords produced by the action of internal muscles upon a species of lyre, or elastic membrane, covered with network, and situated under the wings, the action of which I have often witnessed. The female insect may utter a faint sound, but I do not know how—it is the male who is endowed with the powerful means of instrumentation which I have described.

Though the sound is generally even and continuous as long as the insect is uninterrupted, yet there is a droll variety observable at times—but what it expresses, whether peculiar satisfaction or jealousy, or what other passion, I cannot divine. It has been well described by the word *Pha——ro!* the first syllable being long and sustained, and connected with the second, which is pitched nearly an octave lower, by a drawling descent.

During the whole period of their existence, the closest attention does not detect their eating anything; and with the exception of the trifling injury received by the trees consequent upon the process observed by the female in laying her eggs—which I will describe immediately—they are perfectly innoxious. The end to which they seem to be sent to the upper day is purely confined to the propagation of their species. A few days after their first appearance the female begins to lay her eggs. She is furnished with an ovipositor, situated in a sheath on the abdomen, composed of two serrated, hard parallel spines, which she has the power of working with an alternate perpendicular motion. When her time comes, she selects of the outermost twigs of the forest trees or shrubs, and sets to work and makes a series of longitudinal jagged incisions in the tender bark and wood. In each of these she lays a row of tiny eggs, and then goes to work again. Having deposited to her heart's content, she crawls up the twig a few inches yet further from the termination, and placing herself in a fitting position, makes two or three perpendicular cuts into the very pith. Her duty is now terminated. Both male and female become weak;—the former ceases to be tuneful; the charms of their existence is at an end; they pine away, become blind, fall to the ground by myriads, and in ten or fifteen days after their first appearance, they all perish. Not so, however, their seed. The perforated twigs die, the first wind breaks them from the tree, and scatters them upon the ground. The eggs give birth to a number of small grubs, which are thus enabled to attain the mould without injury; and in it they disappear, digging their way down into the bosom of the earth. Year goes after year—summer after summer, the sun shines in vain to them—they "bide their time!" The recollection of their existence begins to fade: a generation passes away; the surface of the country is altered—lands are reclaimed from the forest—streets are laid out and trampled on for years—houses are built, and pavements hide the soil.

Still, though man may almost forget their existence, God does not. What their life is in the long interval none can divine. Traces of them have been found in digging wells and foundations, eight and ten feet below the surface. When seventeen years have gone by, the memory of them returns, and they are expected. A cold, wet spring may retard their appearance, but never since the attention of man has been directed to them, have they failed—but at the appointed time, by one common impulse, they rise from the earth, piercing their way through the matted sod, through the hard trampled clay of the pathways, through the gravel, between the joints of the stones and pavements, and into the very cellars of the houses,—like their predecessors, to be a marvel in the land, to sing their blithe song of love and enjoyment under the bright sun, and amidst the verdant landscape; like them to fulfil the brief duties of their species, and close their mysterious existence by death. We are still children in the small measure of our knowledge and comprehension, with regard to the phenomena of the natural world!

—LATROBE.

SNAILS.

WE will open the case by claiming for the snails the respect that is always accorded to old and long-established families. There were snails before the Flood—before Adam even—in those far remote eras of the past, when the lower orders of the animal creation had the world all to themselves. The family seems to have "come in" somewhere about the time when the huge Dinotherium wallowed in the rivers of central Europe; and it is not at all improbable that some of the earliest members of it may have banqueted on the selfsame herbage which sustained the enormous bulk of that unwieldy monster. Later down, in the classic days of Greece and Rome, the snails were not only known, but held in great repute, and regularly had the honour of appearing at the tables of wealthy epicures, fresh from contact with a silver gridiron. It was in those days, indeed, that the tribe derived the family name by which it has ever since been known—Helix, a spiral, being the name that was given to the dainty morsel; while the same term, metamorphosed into Helicidæ, now stands, all the world over where the science of zoology obtains, as the distinctive appellation of the wide-spread family. All that by the way, however: what we want to impress upon our readers is, that if there be any honour attached to long descent and distinguished connexions, then that honour can fairly be claimed by the snail family.

It may be as well, too, to observe at once, that though the representatives of the family which make themselves at home in our fields and hedges have nothing particularly attractive in their appearance, that is not by any means the case with those branches of the family that reside abroad. In "foreign parts" there are snails to be found as far exceeding our own in delicacy and beauty of colouring, as there are birds and insects that excel in brilliancy the winged tribes of our woods and fields.

But these gaily-coloured individuals belong, of course, to the rich pastures and the sunny skies of tropic regions; and we do not mean to call in their aid just yet, in order to make good our position as to the claims of the family. Let us come back, therefore, to the little fellow with the dusky spotted shell, that crawls across our garden path, and to his somewhat prettier companions of the hedgerow. And, now observe, that they make their way in the world by means of an expanded disc or foot, which, as it is in close contact with the ventral region of the body, has procured for the tribe a place amongst the great class of *Gasteropods*, or belly-footed molluscs. The foot itself is a very curious organ, and consists of a nearly uniform mass of muscular fibres, interwoven much in the same way as those of the human tongue. The regular gliding motion with which the common snails crawl along, is due to a pair of muscles extending along the centre of the foot; but in some of the species the surface of the foot is divided by a longitudinal line along the centre, the muscles on the two sides of which act in rotation, and so cause the animals to progress in a perpetual zigzag. The glistening slimy tracks which they leave behind—"the silver slimy trails," as poor Clare calls them—are produced by a discharge of mucus, designed to protect their tender bodies, and smooth the asperities of their way. It must be a very comfortable thing for the snails to be able to carpet their path in this easy, off-hand manner, and we confess we like to see the silvery line on posts and pailings, or gravelly walks; but when, as happens sometimes, the little fellows pay us a visit in our parlour, where the place is carpeted beforehand, they might be considerate enough to wipe their feet before coming in.

A good deal of discussion has taken place amongst naturalists, as to whether snails have any eyes or not. The popular notion, of course, is that the little knobs at the extremity of their long feelers or horns are eyes; and though several writers have questioned or boldly denied the truth of this opinion, it seems to be now pretty generally conceded, that the little club-shaped projections are true visual organs. Swammerdam, indeed, long ago demonstrated the matter to his own satisfaction, and pointed out the five distinct parts of which the eye consists.

It would be a difficult matter, probably, to find a person anywhere who had never seen a snail draw in its horns on their being touched;

but how many, we should like to know, have ever closely watched the snail's manner of doing it? The thing is easily seen, and any schoolboy may ascertain how it is done, the next time he stops a snail in his travels across the footpath, and admonishes him in the words of the old doggerel, "to shut up his house and go away home." The secret is, that the *tentacle* or horn is a hollow tube, and in being withdrawn, it is simply inverted and retracted like the finger of a tight glove; only that the extremity, with the eye-spot upon it, is always the first part to disappear. The manner of it is here seen, perhaps, when after the tentacle has been withdrawn, it is again protruded; as you can then readily discern that the organ is lengthened, not by being pushed out from its base, but by gradually unfolding itself; or being everted at the extremity till the clubbed point appears, and the tentacle is fully extended. One cannot but admire the wisdom which thus gives the little mollusc such a ready and effectual means of defending its rather oddly located visual organs. We speak of the wonderful contrivances connected with the human eye, but surely there is something here that is not much less wonderful.

—KEARLEY.

THE CORAL INSECT.

TOIL on! toil on! ye ephemeral train,
Who build in the tossing and treacherous main,
Toil on—for the wisdom of man ye mock,
With your sand-based structures and domes of rock;
Your columns the fathomless fountains lave,
And your arches spring up to the crested wave;

Ye 're a puny race, thus boldly to rear
A fabric so vast in a realm so drear.

Ye bind the deep with your secret zone,
The ocean is seal'd, and the surge a stone;
Fresh wreaths from the coral pavement spring,
Like the terraced pride of Assyria's king;
The turf looks green where the breakers roll'd;
O'er the whirlpool ripens the rind of gold;
The sea-snatch'd isle is the home of men,
And mountains exult where the wave hath been.

But why do you plant, 'neath the billows dark
The wrecking reef for the gallant bark?
There are snares enough on the tented field,
'Mid the blossom'd sweets that the valleys yield;
There are serpents to coil, ere the flowers are up;
There 's a poison-drop in man's purest cup,
There are foes that watch for his cradle-breath,
And why need ye sow the floods with death?

Ye build—ye build—but ye enter not in,
Like the tribes whom the desert devour'd in their sin;
From the land of promise ye fade and die,
Ere its verdure gleams forth on your weary eye;
As the kings of the cloud-crown'd pyramid
Their noteless bones in oblivion hid,
Ye slumber unmark'd 'mid the desolate main,
While the wonder and pride of your works remain.

—SIGOURNEY.

CORAL REEF.

1. Anguillula fluviatilis.
2. Cyclops quadricornis.
3. Actinophrys Sol.
4. Coleps hirtus.
5. Vorticella.
6. Amœba princeps
7. Acineta mystacina.
8. Oxytrycha.
9. Triophthalamus dorsalis.
10. Polyarthra.

LIFE IN A WATER-DROP.

The sun is reflected in the ocean as in the water-drop, and in both are called into existence beings the most varied in size and form. We admire the myriads of creatures which inhabit the depths of the ocean, from the monstrous whale to the tiniest specimen of the finny tribe. But if the size, the power, and the variety of the denizens of the deep excite our admiration, how much more do we find ourselves carried away by that feeling while looking into the water-drop.

Clear and transparent it lies before us: vainly our eye endeavours to discover the least evidence of life, or the smallest creature, in that which seems in itself too small to contain any living object; the breath of our mouth is strong enough to agitate it, and a few rays of the sun are sufficient to convert it into vapour. But we place this drop of water between two clean squares of glass, beneath the microscope, and lo! what life suddenly presents itself: we scarcely trust our senses. The little drop has expanded into a large plain, wonderful shapes rush backwards and forwards, drawing towards and repulsing each other, or resting placidly and rocking themselves, as if they were cradled on the waves of an extensive sea. These are no delusions; they are real, living creatures, for they play with each other, they rush violently upon one another, they whirl round each other, they free and propel themselves, and run from one place in order to renew the same game with some other little creature; or madly they precipitate themselves upon one another, combat and struggle until the one conquers and the other is subdued; or carelessly they swim side by side, until playfulness or rapacity is awakened anew. One sees that these little creatures, which the sharpest eye cannot detect without the aid of the microscope, are susceptible of enjoyment and pain; in them lives an instinct which induces them to seek, and enables them to find, sustenance, which points out and leads them to avoid and to escape the enemy stronger than themselves. Here one tumbles about in mad career and drunken lust, it stretches out its feelers, beats about its tail, tears its fellows, and is as frolicsome as if perfectly happy. It is gay, cheerful, hops and dances, rocks and bends about upon the little waves of the water-drop. There is another creature; it does not swim about—remains upon the same spot—but it contracts itself convulsively, and then stretches itself palpitatingly out again. Who could not detect in these motions the throes of agony; and so it is; for only just now it has freed itself from the jaws of a stronger enemy. The utmost power has it exerted in order to get away; but he must have had a tight hold, severely wounded it, for only a few more throes, each becoming weaker and more faint, it draws itself together, stretches out its whole length once more, and sinks slowly to the bottom. It was a death struggle. It has expired.

On one spot a great creature lies, apparently quiet and indifferent. A smaller one passes carelessly by, and, like a flash of lightning, the first dashes upon it. Vainly does the weaker seek to escape its more powerful enemy; he has already caught it, embraces it, the throes of the vanquished cease—it has become a prey.

This is only a general glance at the life in a water-drop, but how *great* does even this already show the *small;* how wondrously does everything shape itself within that, of which we had formerly not the least conception. These are creatures which Nature nowhere presents to the eye upon an enlarged scale, so marvellous, odd, and also again so beautiful, so merry, happy in their whole life and movements; and although defective, and, in some respects, only one step removed from vegetable life, they are yet animated and possessed of will and power. It would be impossible here to give a description of all, or even of a great part of the ephemerous world in all its varied aspects, but we propose to take a nearer survey of some few at least, in order to display the life which exists in a single drop of water taken from a pond.

Slowly and gracefully through the floods of this small drop of water comes glidingly, swimming along, the little swan animalcule, turning and twisting its long, pliant neck, swaying itself comfortably, and moving in every direction, sucking whatever nourishment or prey may present itself. This animalcule has its name from its likeness to the swan; it carries its neck just as proudly and gracefully-arched, only the head is wanting, for at the end there is a wide opening mouth, surrounded by innumerable beam-like lashes. The entire little creature is transparent, and it seems impossible that any species of nutriment could possibly pass through the thin throat, for even water seems too coarse a material for this small tube; but scarcely does one of the variously formed *monads*, (single cells,) which exist in all waters, and of which many thousands could move and tumble freely about in the hollow of a poppy seed, approach its mouth, ere it gulps them down, we see them gliding through the throat, and see the green, gray, or white monad lying in the little, but for this animalcule, great stomach. This monad is itself an animalcule, a living atom; and possibly a still smaller animalcule serves for its nourishment; but the human eye has not yet penetrated thus far, possibly it may never do so, for the Creator has hidden from the material vision of man the limits of His creating power, alike in the infinitely great as in the infinitesimally small.

Whirling along comes swimming by the side of the swan animalcule, the *Bell.* Here Nature has retained a form out of the vegetable kingdom, for the body of this animalcule is similar to the bell-shaped blossom of a Mayflower, fastened to a long stem; this stem, through which passes a spiral-formed vein, a fine dark tube, is easily movable; it closes itself, screw-like, together and stretches itself out again—this is the tail of the bell animalcule; at the end there is a little knot, and soon this knot becomes attached to the bottom, or to a blade of grass, or to a piece of wood, and the little animalcule is like a ship at anchor in a bay or harbour; its tail extends and turns itself, and the body of the animalcule, the little bell, whose opening is at the top, begins to whirl itself round and round, and this movement is so quick and powerful that it creates, even in the billows of the water-drop, a whirlpool, which keeps ever going round wilder and more violently; it grows to a *Charybdis*, which none of the little monads who are caught within it can escape; the whirlpool is too fierce, they get drawn into it and find a grave in the jaws of the bell animalcule. The bell closes, the tail rolls together, but soon it stretches itself out again; the bell whirls, the whirlpool goes round, and in it many a quiet and thoughtless passing monad is drawn down. But the bell animalcule is also about meeting its punishment; again it whirls its bell violently, the tail breaks from the body, and the bell floats without control hither and thither on the waves of the water-drop; but it knows how to help itself; Nature has provided for such a catastrophe in its creation. The bell sinks to the bottom, and soon the missing tail grows again, and if death even comes, Nature has been so liberal in the creation of this little world—new life and new creatures arise so quickly out of those which have passed away, and so great is their number—that the death of one is less than a drop in the ocean, or a grain of sand in the desert of Sahara.

The lives of innumerable animalcules pass away as a breath, but they rise into existence in equally infinite numbers. The animalcules multiply in every variety of way, but the most curious is that of dividing, and out of the severed parts new animalcules are formed, which, in a few hours, again divide themselves into parts, forming new creatures; and this process of increase proceeds to infinity. Numbers alone are able in some measure to give an idea of this infinite increasing power. An animalcule requires for its parting process about five hours, after which time the new creatures stand then perfect, and these again require the same time for their increase. At this rate of increase, one single animalcule would, by the process of separation, be increased to half a million in four days, and after a month it would be inconceivable where this innumerable quantity of animalcules, which are, singly, imperceptible to the naked eye, can possibly be placed. But Nature has limited even this vast increasing power, and she freely sacrifices millions in order to preserve their species always in their proper quantities. What are, compared with these numbers, the quantities of herrings, sprats, and other fish which crowd the sea in such mighty masses? They vanish into nothingness.

—*Sharpe's Magazine.*

METEOROLOGY—THE AIR-OCEAN.

Enveloping this solid globe of ours are two oceans, one partial, the other universal. There is the ocean of water, which has settled down into all the depressions of the earth's surface, leaving dry above it all the high lands, as mountain ranges, continents, and islands; and there is an ocean of air, which enwraps the whole in one transparent mantle. Through the bosom of that ocean, like fishes with their fins, and whales with their flippers, birds and other winged creatures swim; whilst, like crabs and many shell-fish, man and other mammalia creep about at the bottom of this aerial sea.

The air-ocean, which everywhere surrounds the earth, and feeds and nourishes it, is even more simple, more grand, and more majestic than the "world of waters;" more varied and changeful in its moods of storm and calm, of ebb and flow, of brightness and gloom. The atmosphere is, indeed, a wonderful thing, a most perfect example of the economy of nature. Deprived of air no animal would live, no plant would grow, no flame would burn, no light would be diffused. The air, too, is the sole medium of sound. Without it mountains might fall, but it would be in perfect silence —neither whispers nor thunders would ever be heard.

The atmosphere is supposed to extend from the earth to a height of between forty and fifty miles.

A philosopher of the East, with a richness of imagery truly oriental, thus describes it:—"It surrounds us on all sides, yet we see it not; it presses on us with a load of fifteen pounds on every square inch of surface of our bodies, or from seventy to one hundred tons on us in all, yet we do not so much as feel its weight. Softer than the softest down, more impalpable than the finest gossamer, it leaves the cobweb undisturbed, and scarcely stirs the lightest flower that feeds on the dew it supplies; yet it bears the fleets of nations on its wings round the world, and crushes the most refractory substances with its weight. When in motion, its force is sufficient to level the most stately forests and stable buildings with the earth— to raise the waters of the ocean into ridges like mountains, and dash the strongest ships to pieces like toys. It warms and cools by turns the earth and the living creatures that inhabit it. It draws up vapours from the sea and land, retains them dissolved in itself, or suspended in cisterns of clouds, and throws them down again as rain or dew when they are required. It bends the rays of the sun from their path, to give the twilight of evening and of dawn; it disperses and refracts their various tints to beautify the approach and the retreat of the orb of day. But for the atmosphere sunshine would burst on us and fail us at once, and at once remove us from midnight darkness to the blaze of noon. We should have no twilight to soften and beautify the landscape; no clouds to shade us from the scorching heat, but the bald earth, as it revolved on its axis, would turn its tanned and withered front to the full and unmitigated rays of the lord of day. It affords the gas which vivifies and warms our frames, and receives into itself that which has been polluted by use, and is thrown off as noxious. It feeds the flame of life exactly as it does that of fire; it is in both cases consumed, and affords the food of consumption; in both cases it becomes combined with charcoal, which requires it for combustion, and is removed by it when this is over."

"It is only the girdling, encircling air," says another philosopher, "that flows above and around all, that makes the whole world kin. The carbonic acid with which to-day our breathing fills the air, to-morrow seeks its way round the world. The date-trees that grow around the falls of the Nile will drink it in by their leaves; the cedars of Lebanon will take of it to add to their stature; the cocoa-nuts of Tahiti will grow rapidly upon it; and the palms and bananas of Japan will change it into flowers. The oxygen we are breathing was distilled for us some short time ago by the magnolias of the Susquehanna, and the great trees that skirt the Orinoco and the Amazon; the giant rhododendrons of the Himalayas contributed to it, and the roses and myrtles of Cashmere, the cinnamon tree of Ceylon, and the forest older than the flood, buried deep in the heart of Africa. The rain we see descending was thawed for us out of the icebergs which have watched the polar star for ages, and the lotus lilies have soaked up from the Nile, and exhaled as vapour snows that rested on the summits of the Alps."

"The atmosphere which forms the outer surface of the habitable world is a vast reservoir, into which the supply of food designed for living creatures is thrown; or, in one word, it is itself the food, in its simple form, of all living creatures. The animal grinds down the fibre and tissue of the plant, and the nutritious store that has been laid up between its cells, and converts these into the substance of which its own organs are composed. The plant acquires the organs and nutritious store, thus yielded up as food to the animal, from the air surrounding it."

"But animals are furnished with the means of locomotion and of seizure—they can approach their food, and lay hold of and swallow it; plants must wait till their food comes to them. No solid particles find access to their frames; the restless ambient air, which rushes past them loaded with the carbon, the hydrogen, the oxygen, the water, everything they need in the shape of supplies, is constantly at hand to minister to their wants, not only to afford them food in due season, but in the shape and fashion in which alone it can avail them."

There is no employment more ennobling to man and his intellect than to trace the evidences of design and purpose in the Creator, which are visible in all parts of the creation. Hence, to him who studies the physical relations of earth, sea, and air, the atmosphere is something more than a shoreless ocean, at the bottom of which he creeps along. It is an envelope or covering for the dispersion of light and heat over the surface of the earth; it is a sewer into which, with every breath we draw, we cast vast quantities of dead animal matter; it is a laboratory for purification, in which that matter is recompounded and wrought again into wholesome and healthful shapes; it is a machine for pumping up all the rivers from the sea, and conveying the waters from their fountains in the ocean to their sources in the mountains; it is an inexhaustible magazine, marvellously adapted for benign and beneficient purposes.

—MAURY.

ATMOSPHERIC PHENOMENA.

MOISTURE—EVAPORATION—DEW—MISTS AND CLOUDS—RAIN, SNOW, AND HAIL.

PLANTS derive the moisture which is necessary for their support and growth mainly from the moisture held in the atmosphere as vapour. Evaporation is well illustrated by the gradual disappearance of a pool of water, and by the drying of wet bodies. Thus water is diffused through the air as an invisible vapour. The capacity which the air has of holding vapour increases with its temperature; hence the greater rapidity of evaporation in warm than in cold air. Beyond the capacity of the surrounding air, evaporation will not go on; and hence when the air is as highly saturated with vapour as its temperature admits of, it is said to be fully charged; if it holds fifty per cent., it is said to be half charged; if twenty-five per cent., one quarter charged, and so on. The degree of charge, therefore, shows only the amount of moisture in the air *as compared with its capacity at its then temperature*, so that the air is generally moister in winter than in summer, though less saturated with vapour.

If the air is by any cause cooled down below the temperature at which the moisture which it holds will be its full charge, a part of its vapour will necessarily separate from it in the form of water. Thus we see that cold bodies placed in the open air became studded with drops of water—*dew-drops*—because they cool down the surrounding air below its point of full charge. The same phenomenon is daily witnessed in the windows of inhabited rooms. The cold panes cool down the warm moist air of the room, lessen the amount of moisture which it is capable of containing, and cause it to part with its superabundance in the form of water.

Dew, after sunset, is caused by the temperature of moist, solid bodies falling below that of the air, the extent to which the cooling is carried depending on the power which the substances have of radiating or parting with the heat which they have absorbed during the day. Plants radiate better than stones or soil, and these again better than metals. Dew is deposited most plentifully in cloudless, starry nights, because, in these circumstances, radiation goes on more quickly than when the sky is clouded. Under the clear skies of the tropics the effect of the fall of dew is like that of a smart shower of rain. When the dew is frozen it is called hoar-frost.

Mists and Clouds.—The dew-deposits of which we have been speaking are brought on by means, and on the surface, of bodies surrounded by the air; but if a large mass of the air is cooled down throughout below dew-point, (that is, below the point at which it is overcharged with moisture, and consequently begins to deposit dew-drops,) the water that separates from it does not run together into drops, but forms little vapour-vesicles, or cloud-bubbles, which float in the air, containing within these thin bulbs air fully charged with moisture. This state of the atmosphere causes mists. Clouds are only masses of mist in the upper air, caused by the cooling of the higher layers of the atmosphere.

Rain, Snow, Hail.—If, being on a mountain while it rains, you enter the region of clouds, you will find yourself suddenly surrounded with thick masses of fog, and will perceive the fine droplets of the falling mists. But these little drops become larger as they fall; for, just as happens when any other cold body is plunged into moist air, water is thrown down upon the surfaces of these little drops on their way down through the lower, warmer, and vapour-charged layers of the atmosphere. The rain, therefore, which comes down to the earth is derived not only from the clouds floating in the higher atmosphere, which are only its first sources, but also from the lower regions between them and the earth, the whole of which contribute to its increase as it descends. A great difference may, therefore, be found between the amount of rain which falls on the top of a mountain, or even of a high tower, and that which is caught during the same time at the foot of either. Thus the yearly rain-fall on the roof of the Royal Palace at Berlin is eighteen inches in depth, while that on the pavement of the Palace-Place amounts to twenty inches.

When the moist air in the upper regions is cooled down below the freezing-point, the water that it lets fall solidifies and comes down as snow. It is often remarked that it rains on the low-lying lands while it is snowing on the mountains. In such case the rain was withdrawn from the moist, cold air, in the form of snow, but was melted during its fall through the lower and warmer regions. This thawing is often imperfect; it then rains and snows at once, or the snow-flakes, only softening, cling together, and come down as sleet, which falls so often when winter is passing into spring. Sleet is met with in summer only on high mountains. It is probable that hail consists of flakes of snow or sleet, which have been formed in the upper regions, and round which, on their way down, the clear crust of ice was formed, which in almost all hail-stones, surrounds a core of white within.

On the crests of very high mountains—for instance, on the Alps—single clouds are often seen to hang for days apparently motionless. They are, however, in ceaseless motion, just as is the moist air from which they are formed, as it sweeps over the cold and perhaps, snow-capped peaks. With this air they travel on, and vanish again as soon as they are out of reach of the cooling influence; not, however, generally without leaving behind a part of their moisture as a fall of rain or snow. Thus the Alps are often, for many days together, shrouded in dense clouds, from which rain pours heavily every day, while over the warm valley of the Po, notwithstanding the constant south-wind, the sky has never been clouded for a moment. In the same manner all high mountains are withdrawing the waters from the air, even when it does not rain on the plains. Thus they are, in all parts of the world, the spots which form the chief points for the settlement of the moisture of the air, and are the main feeders of the rivers.

The wide plains of Northern India are, as you know, burning hot and dry during the summer. The currents of air rising up from the heated soil hinder the fall of wet from the air. The waters of the air, which are brought in unceasingly from the Indian Ocean by the south wind, (the summer monsoon,) cannot, therefore, be set down before they reach the Himalaya mountains, which, stretching for a length of nearly fourteen hundred miles, almost due east and west, form the boundary of India. Here, however, the moisture is so thoroughly arrested, that the south wind having passed the mountain-range, is almost completely dry before it reaches Inland Asia. Thus the steppes of arid Asia form, for the most part, dry, barren wastes, with very hot summers and severe winters.

—CONSTABLE'S *Sixth Reader.*

THE CLOUD.

I BRING fresh showers for the thirsting flowers,
From the seas and the streams;
I bear light shade for the leaves when laid
In their noonday dreams;
From my wings are shaken the dews that waken
The sweet birds every one,
When rocked to rest on their mother's breast,
As she dances about the sun.
I wield the flail of the lashing hail,
And whiten the green plains under;
And then again I dissolve it in rain,
And laugh as I pass in thunder.

I sift the snow on the mountains below,
And their great pines groan aghast;
And all the night 'tis my pillow white,
While I sleep in the arms of the blast.
Sublime on the towers of my skiey bowers,
Lightning, my pilot, sits;
In a cavern under is fettered the thunder—
It struggles and howls by fits:

Over earth and ocean, with gentle motion,
  This pilot is guiding me,
Lured by the love of the genii that move
  In the depths of the purple sea;
Over the rills, and the crags, and the hills,
  Over the lakes and the plains,
Wherever he dream, under mountain or stream,
  The spirit he loves remains;
And I all the while bask in heaven's blue smile,
  While he is dissolving in rains.

The sanguine sunrise, with his meteor eyes,
  And his burning plumes outspread,
Leaps on the back of my sailing rack,
  When the morning star shines dead;
As on the jag of a mountain crag,
  Which an earthquake rocks and swings,
An eagle, alit, one moment may sit,
  In the light of its golden wings.
And when sunset may breathe, from the lit sea beneath,
  It ardours of rest and love,
And the crimson pall of eve may fall
  From the depth of heaven above;
With wings folded I rest, on mine airy nest,
  As still as a brooding dove.

That orbed maiden, with white fire laden,
  Whom mortals call the moon,
Glides glimmering o'er my fleece-like floor,
  By the midnight breezes strewn;
And wherever the beat of her unseen feet,
  Which only the angels hear,
May have broken the woof of my tent's thin roof,
  The stars peep behind her and peer;
And I laugh to see them whirl and flee,
  Like a swarm of golden bees,
When I widen the rent in my wind-built tent,
  Till the calm rivers, lakes and seas,
Like strips of the sky fallen through me on high,
  Are each paved with the moon and these.

I bind the sun's throne with a burning zone,
  And the moon's with a girdle of pearl;
The volcanoes are dim, and the stars reel and swim,
  When the whirlwinds my banners unfurl.
From cape to cape, with a bridge-like shape,
  Over a torrent sea,
Sunbeam proof I hang like a roof,
  The mountains its columns be.
The triumphal arch through which I march,
  With hurricane, fire, and snow,
When the powers of the air are chained to my chair,
  Is the million-coloured bow;
The sphere-fire above its soft colours wove,
  While the moist earth was laughing below.

I am the daughter of earth and water,
  And the nursling of the sky;
I pass through the pores of the ocean and shores;
  I change, but I cannot die.
For, after the rain, when, with never a stain,
  The pavilion of heaven is bare,
And the winds and sunbeams, with their convex gleams,
  Build up the blue dome of air,
I silently laugh at my own cenotaph,
  And out of the caverns of rain,
Like a child from the womb, like a ghost from the tomb,
  I arise and unbuild it again.

—SHELLEY.

A STORM AMONG THE ALTAI MOUNTAINS.

THE ascent of the Cholsoun from the north side is not abrupt, though the last half verst is steep and rocky: nevertheless, we rode our horses to the summit, or rather to the foot of the large rocky peaks that shoot far above the rounded mountain top. These are bare granite, without a blade of grass upon them, and do not form a continuous ridge or crest on the mountain, but stand up in isolated masses, often at a considerable distance from each other. Having ascended with some difficulty to the top of one of these peaks, I saw our little caravan, composed of the men I had left to proceed by another route, skirting the mountain lower down. I knew that they would cross the summit seven or eight versts to the east, go straight to the Cholsoun pass, and descend into a valley on the south, which I had arranged should be our place of rest for the night.

The views from this part of the chain are very grand. On one side, Nature exhibits her most rugged forms, peaks and crags of all shapes rising up far into the clear blue vault of heaven; while on the other, mountain rises above mountain, vanishing into distance, until they melt into forms like thin gray clouds on the horizon. It was impossible to spare much time going from place to place, looking to the north, south, or west, to decide which view I should sketch first. The chains to the north happened to be beautifully lighted up, some in sunshine, others in shade, producing a wonderful effect of distance and space. This induced me to sit down to work in right good earnest, and I was soon so absorbed in my occupation, that I thought neither of time, distance, nor the country we had to ride over. Our horses had been secured and left to feed, and my men were much interested in my work, until at last, as I supposed, they grew weary. First one would leave, and go to the south side of the rocks under which I was sketching. Soon after he returned the other went; yet they said nothing. I had now been at work more than two hours, and this going to and fro had occurred several times. At length I was certain that they wished to speak to me. I looked at them, and waited for the communication. Then one of them said in his native language, "It will thunder soon," and made a sign for me to go with him. I put down my sketch, and hurried to the other side of the peak, when I beheld the cause of their alarm: evidently a frightful storm was coming toward us, for the high peaks to the west were just being wrapped in a terrible black mantle. There was not a moment to lose; the men ran to bring the horses, and I hastened to pack up my sketching materials. This was but the work of a few minutes. We then mounted and rode past the rocks to see if the storm was approaching. Several of the peaks were already obscured, and now the clouds were wheeling round a very high summit, which I supposed to be eight, or, at most, ten versts distant, across a deep valley. To be caught on this summit in such a storm was something fearful, and the men were really alarmed. There was only one place on the south side by which we could descend: it was the Cholsoun pass, and that was, perhaps, more than eight versts distant. Having watched the storm two or three minutes, we heard the distant thunder, and then knew that the conflict of the elements had begun.

Without speaking a word, we turned our horses, and started off at a gallop. It was a race for the pass, as it was only in this ravine that we could hope for shelter. Every few minutes the thunder rolled nearer and nearer, and on we galloped; the horses, with an instinctive dread of what was following, putting forth their full powers without either whip or spur. Road or track there was none; only some high rocky peaks pointed out to my companions the head of the pass. Our course was straight toward these; sometimes over fine mossy turf, then over ground rough and stony, which would, under any other circumstances, have caused both horse and rider to hesitate before dashing onward at the speed at which we were going. The storm was still behind us, for as yet we had only seen the flash, but not the streams of lightning that were descending every two or three minutes in our rear, followed by claps of thunder, which resounded among the mountains until the distant echo was lost in another loud roar. At a short distance in front of us I beheld huge pillars of rock rising up fifty or sixty feet, which reminded me of Stonehenge, but on a most gigantic scale. My men turned a little to the left to avoid this labyrinth of rocks. I looked at the place with intense interest, determined to visit it, if possible, on the morrow. We were within a couple of versts of the head of the pass when we heard a great rushing sound behind us. Instantly our heads were turned to see what was coming, when we beheld branches of cedar torn up from the valley, carried over the rocky peaks, and whirled high into the air: this was the blast before the storm, which now swept on with terrific force. Fortunately for us, the rocky pillars broke the fury of the gust, or we should have been hurled down to a certainty; for, at a short distance to each side of us, the dwarf cedars which creep over the rocks were torn up, and carried along by the hurricane. We found it difficult to sit our horses, as they swerved and bounded on when the fearful squall rushed past.

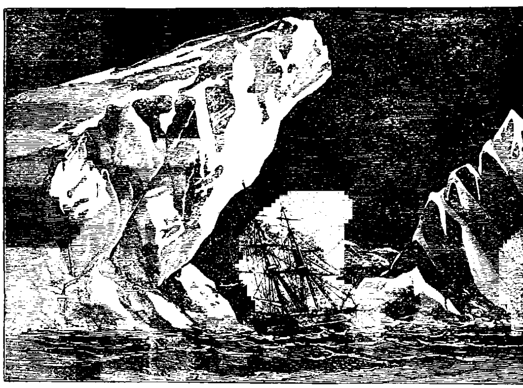
The storm was now near, but for the last few minutes there had not been a flash. This was even more appalling than the loud thunder. I turned my head, and saw a thick red stream strike among the rocks we had just passed; at the same instant there were three reports like the firing of a heavily-loaded musket over our heads, and then came a crash which made our horses shudder, although in a gallop. Now came hailstones so thick, that for a moment they almost blinded us; the lightning flashed in quick succession, and the thunder was incessant.

We reached the pass, and turned into its rugged jaws with a delight known only to a mariner when he runs his sinking craft into a safe haven. In about ten minutes we were quietly standing under the shelter of some friendly rocks, our tired horses trembling with fear. The men crossed themselves; nor did I forget to offer up my thanks for our preservation. The storm still raged above us with terrific fury and awful grandeur; but the overhanging masses under which we crouched afforded us complete protection, and I listened to the dreadful tempest with mingled feelings of awe and pleasure. In a very few minutes the ground was covered with a thick coating of hail, giving a wintry aspect to the scene which had been so calm and beautiful two short hours before. The storm rolled on: in about an hour we could only hear its murmurings in the distance. Presently the clouds were dispersed; the sun shone out in all his splendour, rendered still more brilliant by the intensely black masses of vapour which enveloped the distant crags. My companions now discovered that we were not in the Cholsoun pass, but in a small ravine down which it was impossible to proceed even on foot, for at a very short distance below our sheltering place the precipices were perpendicular to the depth of at least three hundred feet, over which a little stream was leaping, to be dispersed in vapour before reaching the bottom. It was the dashing of the water which drew my attention to it; from below, no doubt, it must have appeared exceedingly pretty.

It was now quite time to descend, as our people were encamped somewhere in the valley beneath. One of my men found that we had missed the pass, and gone considerably beyond it during the storm. We therefore rode back and turned into a ravine, which he said would lead us to the right track lower down. This proved correct; and in about two hours we were quietly seated by our camp-fire, under some magnificent cedars, on the bank of a roaring torrent greatly swollen by the storm. Our companions had heard the thunder in the distance, and there had been a few drops of rain, but not even enough to wet the ground. The forest was so thick around our camp that they could not see the mountains; it was only the rising and thundering of the torrent that told them what had happened there.

After taking sufficient refreshment, and writing up my journal by

the light of a blazing fire, I turned down at the root of a magnificent cedar, wrapped myself in my cloak, and slept soundly until morning.
—Atkinson.



AMONG THE ICE.

By Saturday morning it blew a perfect hurricane. We had seen it coming, and were ready with three good hawsers out a-head, and all things snug on board. Still it came on heavier and heavier, and the ice began to drive more wildly than I thought I had ever seen it. I had just turned in to warm and dry myself during a momentary lull, and was stretching myself out in a bunk, when I heard the sharp twanging snap of a cord. Our six-inch hawser had parted, and we were swinging by the two others; the gale roaring like a lion to the southward.

Half a minute more, and "twang, twang!" came a second report. I knew it was the whale line by the shrillness of the ring. Our noble ten-inch manilla still held on. I was hurrying my last sock into its sealskin boot, when M'Garry came waddling down the companion-ladders:—"Captain Kane, she wont hold much longer: it's blowing tremendously, and I am afraid to surge."

The manilla cable was proving its excellence when I reached the deck; and the crew, as they gathered round me, were loud in its praises. We could hear its deep Æolian chant, swelling through all the rattle of the running gear and moaning of the shrouds. It was the death song! The strands gave way with the noise of a shotted gun; and, in the smoke that followed their recoil, we were dragged out by the wild ice, at its mercy.

We steadied, and did some petty warping, and got the brig a good bed in the rushing drift; but it all came to nothing. We then tried to beat back through the narrow ice-clogged water-way, that was driving, a quarter of a mile wide, between the shore and the pack. It cost us two hours of hard labour, skilfully bestowed I thought; but at the end of that time, we were at least four miles off, opposite the great valley in the centre of Bedevilled Reach. Ahead of us, further to the north, we could see the strait growing still narrower, and the heavy ice-tables grinding up, and clogging it between the shore cliffs on one side, and the ledge on the other. There was but one thing left for us;—to keep in some sort the command of the helm, by going freely where we must otherwise be driven. We allowed her to scud under a reefed foretopsail; all hands watching the enemy, as we closed in silence.

At seven in the morning, we were close upon the piling masses. We dropped our heaviest anchor with the desperate hope of winding the brig; but there was no withstanding the ice-torrent that followed us. We had only time to fasten a spar as a buoy to the chain, and let her slip. So went our best bower!

Down we went upon the gale again, helplessly scraping along a lee of ice seldom less than thirty feet thick; one floe, measured by a line as we tried to fasten to it more than forty. I had seen such ice only once before, and never in such rapid motion. One upturned mass rose above our gunwale, smashing in our bulwarks, and depositing half a ton of ice in a lump upon our decks. Our staunch little brig bore herself through all this wild adventure as if she had a charmed life.

Now a new enemy came in sight ahead. Directly in our way, just beyond the line of floe-ice against which we were alternately sliding and thumping, was a group of bergs. We had no power to avoid them; and the only question was, whether we were to be dashed in pieces against them, or whether they might not offer us some providential nook of refuge from the storm. But, as we neared them, we perceived that they were at some distance from the floe edge, and separated from it by an interval of open water. Our hopes rose as the gale drove us toward this passage, and into it; and we were ready to exult, when, from some unexplained cause,—probably an eddy of the wind against the lofty ice-walls,—we lost our headway. Almost at the same moment we saw that the bergs were not at rest; that with a momentum of their own they were bearing down upon the other ice, and that it must be our fate to be crushed between the two.

Just then, a broad sconce-piece, or low water-washed berg, came driving up from the southward. The thought flashed upon me of one of our escapes in Melville Bay; and as the sconce moved rapidly close alongside us, M'Garry managed to plant an anchor on its slope, and hold on to it by a whale line. It was an anxious moment. Our noble tow-horse, whiter than the pale horse that seemed to be pursuing us, hauled us bravely on; the spray dashing over his windward flanks, and his forehead ploughing up the lesser ice, as if in scorn. The bergs encroached upon us as we advanced: our channel narrowed to a width of perhaps forty feet: we braced the yards to clear the impending ice-walls.

We passed clear, but it was a close shave;—so close that our quarter-boat would have been crushed if we had not taken it in from the davits;—and we found ourselves under the lee of a berg, in a comparatively open lead. Never did heart-tried men acknowledge with more gratitude their merciful deliverance from a wretched death.

The day had already its full share of trials; but there were more to come. A flaw drove us from our shelter, and the gale soon carried us beyond the end of the lead. We were again in the ice, sometimes escaping its onset by warping; sometimes forced to rely on the strength and buoyancy of the brig to stand its pressure; sometimes scudding wildly through the half-open drift. Our jibboom was snapped off in the cap; we carried away our barricade stanchions, and were forced to leave our little Eric, with three brave fellows and their warps, out upon the floes behind us.

A little pool of open water received us at last. It was just beyond a lofty cape that rose up like a wall, and under an iceberg that anchored itself between us and the gale. And here, close under the frowning shore of Greenland, ten miles nearer the Pole than our holding ground of the morning, the men turned in to rest.

I was afraid to join them, for the gale was unbroken, and the floes kept pressing heavily upon our berg,—at one time so heavily as to sway it on its vertical axis toward the shore, and make its pinnacle overhang our vessel. My poor fellows had but a precarious sleep before our little harbour was broken up. They hardly reached the deck, when we were driven astern, our rudder splintered, and the pintles torn from their boltings.

Now began the nippings. The first shock took us on our port-quarter; the brig bearing it well, and, after a moment of suspense, rising by jerks handsomely. The next was from a veteran floe, tongued and honey-combed, but floating in a single table of over twenty feet in thickness. Of course no wood or iron could stand this; but the shoreward face of our iceberg happened to present an inclined plane, descending deep into the water; and up this the brig was driven, as if some great steam screw-power was forcing her into a dry dock.

At one time I expected to see her carried bodily up its face, and tumbled over on her side. But one of those mysterious relaxations, which I have elsewhere called the pulses of the ice, lowered us quite gradually down again into the rubbish, and we were forced out of the line of pressure toward the shore. Here we succeeded in carrying out a warp, and making fast. We grounded as the tide fell; and would have heeled over to seaward, but for a mass of detached land-ice that grounded alongside of us; and, although it stove our bulwarks as we rolled over it, shored us up.

—KANE'S *Arctic Explorations.*

A SONG FOR ST CECILIA'S DAY, 1687.

FROM harmony, from heavenly harmony,
   This universal frame began:
When nature underneath a heap
   Of jarring atoms lay,
And could not heave her head,
The tuneful voice was heard from high,
   Arise, ye more than dead.
Then cold and hot and moist and dry,
   In order to their stations leap,
   And Music's power obey.
From harmony, from heavenly harmony,
   This universal frame began:
   From harmony to harmony,
Through all the compass of the notes it ran,
   The diapason closing full in Man.

What passion cannot Music raise and quell?
  When Jubal struck the chorded shell,
    His listening brethren stood around,
  And, wondering, on their faces fell
    To worship that celestial sound.
Less than a God, they thought, there could not dwell
  Within the hollow of that shell,
  That spoke so sweetly and so well.
What passion cannot Music raise and quell?

The trumpet's loud clangour
  Excites us to arms,
With shrill notes of anger
  And mortal alarms.
The double double double beat
  Of the thundering drum
  Cries, Hark! the foes come;
Charge, charge, 'tis too late to retreat.
  The soft complaining flute
  In dying notes discovers
  The woes of hopeless lovers,
Whose dirge is whispered by the warbling lute.

  Sharp violins proclaim
Their jealous pangs and desperation,
Fury, frantic indignation,
Depth of pains, and height of passion,
  For the fair, disdainful dame.

But oh! what art can teach,
What human voice can reach,
The sacred organ's praise?
  Notes inspiring holy love,
Notes that wing their heavenly ways
  To join the choirs above.

Orpheus could lead the savage race,
And trees uprooted left their place,
  Sequacious of the lyre:
But bright Cecilia raised the wonder higher:
When to her organ vocal breath was given,
An angel heard and straight appeared,
  Mistaking earth for heaven.

GRAND CHORUS.

As from the power of sacred lays
  The spheres began to move,
And sung the great Creator's praise
  To all the blessed above;
So, when the last and dreadful hour
This crumbling pageant shall devour,
The trumpet shall be heard on high,
The dead shall live, the living die,
And Music shall untune the sky.

— DRYDEN.

CHEMISTRY.

THE science of Chemistry has for its object the study of the nature and properties of the different substances of which the earth, the waters, the air, and their inhabitants, (namely, plants and animals,) are composed. In a word, it embraces the study of everything under heaven accessible to man. In its highest branches it aims at discovering the laws or rules which regulate the formation of chemical compounds generally, and in its useful applications it has been already exceedingly serviceable in directing and improving the various arts of common life, as agriculture, the working of metals, dyeing, and many other pursuits. It serves also to guide the medical man in the preparation of his remedies, and also occasionally in distinguishing between diseases which are in other respects much alike. There is, indeed, scarcely a situation in life in which a knowledge of chemistry may not prove directly useful. Lastly, it is a science, the study of which, from its simplest beginnings to its highest attempts, is rendered delightful by the constant succession of new and interesting things brought before the eye and the mind.

Almost all the substances just spoken of as the objects of chemical study, namely, the various rocks, clays, sands, and soils which compose the solid earth; the water of seas and rivers; the materials of plants and animals, are of a compound nature, that is, are made up of two or more other substances united or combined together in a manner so close and intimate as not to be generally separable by any common means; and the compound so produced is almost always different in properties and appearance from the substances of which it is really composed. These latter may themselves be of a compound nature, and each formed in like manner by the union of two or more other substances very strongly joined together, but still capable of separation by proper chemical means. Such an act of separation is called by the name of *chemical decomposition,* and the original compound substance is in such a case said to be chemically decomposed into its *components* or *constituents.*

As an example:—A piece of limestone, coral-rock, or chalk, heated red-hot for half an hour, loses nearly half its weight, and becomes quicklime. The loss is caused by the separation from the limestone of another substance (called carbonic acid) which is carried off by the vapours of the fire, but which could be easily caught and collected by proper means. The limestone is therefore decomposed by the action of heat into its components, lime and carbonic acid, which, by their union, formed the limestone, or, as it is called in chemical speech, carbonate of lime.

Both the carbonic acid, however, and the lime, are themselves of a compound nature; the first may be decomposed into two other substances, carbon and oxygen, and the second into a metallic matter, calcium and oxygen. Mere heat, indeed, will not produce this effect, which can only be brought about by very powerful means of decomposition.

In this manner a limit or boundary is sooner or later reached, and substances obtained which completely defy the efforts of the chemist to decompose them further; the carbon, oxygen, and calcium of the limestone arrived at by two successive steps of decomposition are found to resist all further attempts at decomposition; such substances are called *simple* or *elementary,* or sometimes, *chemical elements.*

The number of these elementary substances known to exist, alters with the progress of chemical science; substances which at one period resisted decomposition gave way when new and more powerful means for that purpose were applied; besides which, minerals and waters containing new elements are met with from time to time. At present they amount to over sixty. Very many of them, however, are exceedingly rare, the compounds containing them being found in very small quantities.

Elementary substances are always divided by chemists into two classes, namely, *metals* and *non-metallic substances.* The well-known and abundant metals, gold, silver, copper, iron, tin, and lead, together with a great number of rarer and less familiar substances, will stand in the first class. The components of the atmosphere, oxygen and nitrogen, hydrogen, sulphur, phosphorus, and several others, belong to the second class. Several of the elements, however, possess properties which render it difficult to decide in which class to place them.

It is very important to understand what in science is called a *physical state* or *condition* of a substance, simple or compound, as contrasted with its chemical nature. There are three such states, the *solid*, *fluid* or *liquid*, and *gaseous*, which one and the same substance may assume, passing from one to the other, backwards and forwards, without the slightest change of chemical nature. For example, water, as commonly met with, is liquid, but when cooled sufficiently it takes the solid form, and becomes ice; and, on the other hand, when sufficiently heated, boils and becomes steam or vapour, which is the gaseous condition of water. By cooling this vapour, it again becomes liquid, and, by still further cooling, it freezes to ice, and all this without the least chemical change or decomposition of any kind. The metal zinc melts easily when heated to a moderate extent, and, when still further heated, vaporises, or becomes converted into vapour, which, by cooling again, becomes liquid; and lastly, solid. In fact, very many substances, simple and compound, behave in the same manner, and have the power of existing in all three states, and a still greater number in two of them, the solid and the liquid, or the liquid and the gaseous.

Although a gas or vapour (which is the same thing in reality) is very frequently invisible to the eye, it is as much substance or matter as a solid or a fluid; it fills vessels, and possesses weight, and can be handled and experimented with, by proper means, with as much ease and certainty as a solid or a liquid. Some gases, however, are coloured yellow, violet, or red, and then they become, of course, evident to the eye.

The physical state of a substance is, in fact, dependent upon its relations to heat; a subject which must be considered in a future lesson. —FOWNES.

THE CHEMISTRY OF A CANDLE.

THE Wilkinsons were having a small party—it consisted of themselves and Uncle Bagges—at which the younger members of the family, home for the holidays, had been just admitted after dinner. Uncle Bagges was a gentleman from whom his affectionate relatives cherished expectations of a testamentary nature. Hence the greatest attention was paid by them to the wishes of Mr Bagges, as well as to every observation which he might be pleased to make.

"Eh! what? you sir," said Mr Bagges, facetiously addressing himself to his eldest nephew, Harry—"eh! what? I am glad to hear, sir, that you are doing well at school. Now—eh? now, are you clever enough to tell me where was Moses when he put the candle out?"

"That depends, uncle," answered the young gentleman, "on whether he had lighted the candle to see with at night, or by daylight to seal a letter."

"Eh? very good, now! 'Pon my word, very good," exclaimed Uncle Bagges. "You must be Lord Chancellor, sir—Lord Chancellor, one of these days."

"And now, uncle," asked Harry, who was a favourite with the old gentleman, "can you tell me what you do when you put a candle out?"

"Clap an extinguisher on it, you young rogue, to be sure."

"Oh, but I mean, you cut off its supply of oxygen," said Master Harry.

"Cut off its ox's—eh? what?"

"He means something he heard at the Royal Institution," observed Mrs Wilkinson. "He reads a great deal about chemistry, and he attended Professor Faraday's lectures there on the chemical history of a candle, and has been full of it ever since."

"Now, you sir," said Uncle Bagges, "come you here to me, and tell me what you have to say about this chemical, eh?—or comical; which?—this—comical chemical history of a candle."

"Harry, don't be troublesome to your uncle," said Mr Wilkinson.

"Troublesome? Oh, not at all. I like to hear him. Let him teach his old uncle the comicality and chemicality of a farthing rushlight."

"A wax candle will be nicer and cleaner, uncle, and answer the same purpose. There's one on the mantle-shelf. Let me light it."

"Take care you don't burn your fingers, or set anything on fire," said Mrs Wilkinson.

"Now, uncle," commenced Harry, having drawn his chair to the side of Mr Bagges, "we have got our candle burning. What do you see?"

"Let me put on my spectacles," answered the uncle.

"Look down on the top of the candle around the wick. See, it is a little cup full of melted wax. The heat of the flame has melted the wax just round the wick. The cold air keeps the outside of it hard, so as to make the rim of it. The melted wax in the little cup goes up through the wick to be burned, just as oil does in the wick of a lamp. What do you think makes it go up, uncle?"

"Why—why, the flame *draws* it up, doesn't it?"

"Not exactly, uncle. It goes up through little tiny passages in the cotton wick, because very, very small channels, or pipes, or pores, have the power in themselves of sucking up liquids. What they do it by is called cap—something."

"Capillary attraction, Harry," suggested Mr Wilkinson.

"Yes, that 's it; just as a sponge sucks up water, or a bit of lump-sugar the little drop of tea or coffee left in the bottom of a cup. Now I 'll blow the candle out; not to be in the dark, though, but to see into what it is. Look at the smoke rising from the wick. I 'll hold a piece of lighted paper in the smoke, so as not to touch the wick. But see, for all that, the candle lights again. So this shows that the melted wax sucked up through the wick is turned into vapour, and the vapour burns. The heat of the burning vapour keeps on melting more wax, and that is sucked up too within the flame, and turned into vapour and burned, and so on till the wax is all used up, and the candle is gone. So the flame, uncle, you see, is the last of the candle, and the candle seems to go through the flame into nothing, although it doesn't, but goes into several things; and isn't it curious, as Professor Faraday said, that the candle should look so splendid and glorious in going away?"

"How well he remembers, doesn't he?" observed Mrs Wilkinson.

"I daresay," proceeded Harry, "that the flame of the candle looks flat to you; but if we were to put a lamp-glass over it, so as to shelter it from the draught, you would see it is round—round sideways, and running up to a peak. It is drawn up by the hot air; you know that hot air always rises, and that is the way smoke is taken up the chimney. What should you think was in the middle of the flame?"

"I should say fire," replied Uncle Bagges.

"Oh, no. The flame is hollow. The bright flame we see is something no thicker than a thin peel or skin, and it does not touch the wick. Inside of it is the vapour I told you of just now. If you put one end of a bent pipe into the middle of the flame, and let the other end of the pipe dip into a bottle, the vapour or gas from the candle will mix with the air there; and if you set fire to the mixture of gas from the candle and air in the bottle, it would go off with a bang."

"I wish you 'd do that, Harry," said Master Tom, the younger brother of the juvenile lecturer.

"I want the proper things," answered Harry. "Well, uncle, the flame of the candle is a little shining case, with gas in the inside of it and air on the outside, so that the case of flame is between the air and the gas. The gas keeps going into the flame to burn, and when the candle burns properly none of the gas ever passes out through the flame, and none of the air ever gets in through the flame to the gas. The greatest heat of the candle is in this skin, or peel, or case of flame."

"Case of flame!" repeated Mr Bagges. "Live and learn. I should have thought a candle-flame was as thick as my poor old noddle."

"I can show you the contrary," said Harry. "I take this piece of white paper, look, and hold it a second or two down upon the candle flame, keeping the flame very steady. Now I 'll rub off the black of the smoke, and—there—you find that the paper is scorched in the shape of a ring, but inside the ring it is only dirtied, and not singed at all."

"Seeing is believing," remarked the uncle.

"But," proceeded Harry, "there is more in the candle flame than the gas that comes out of the candle. You know a candle will not burn without air. There must be always air around the gas, and touching it like, to make it burn. If a candle has not got enough air it goes out, or burns badly, so that some of the vapour inside of the flame comes out through it in the form of smoke, and this is the reason of a candle smoking. So now you know why a great clumsy dip smokes more than a neat wax candle: it is because the thick wick of the dip makes too much fuel in proportion to the air that can get to it."

"Dear me! Well, I suppose there is a reason for everything," exclaimed the young philosopher's mamma.

"What should you say, now," continued Harry, "if I told you that the smoke that comes out of a candle is the very thing that makes a candle burn with a bright light? Yes; a candle shines by consuming its own smoke. The smoke of a candle is a cloud of small dust; and the little grains of the dust are bits of charcoal, or carbon, as chemists call it. They are burned the moment they are made, and the place they are made in is the case of flame itself, where the strongest heat is. The great heat separates them from the gas which comes from the melted wax, and, as soon as they touch the air on the outside of the thin case of flame, they burn."

"Can you tell how it is that the little bits of carbon cause the brightness of the flame?" asked Mr Wilkinson.

"Because they are pieces of solid matter," answered Harry. "To make a flame shine, there must be always some solid—or at least liquid—matter in it."

"Very good," said Mr Bagges; "solid stuff necessary to brightness."

"Some gases and other things," resumed Harry, "that burn with a flame you can hardly see, burn splendidly when something solid is put into them. Oxygen and hydrogen—tell me if I use too hard words, uncle—oxygen and hydrogen gases, if mixed together and blown through a pipe, burn with plenty of heat, but with very little light. But if their flame is blown upon a piece of quicklime, it gets so bright as to be quite dazzling. Make the smoke of oil of turpentine pass through the same flame, and it gives the flame a beautiful brightness directly."

"I wonder," observed Uncle Bagges, "what has made you such a bright youth."

"Taking after my uncle, perhaps," retorted his nephew. "Don't put my candle and me out. Well, carbon or charcoal is what causes the brightness of all lamps, and candles, and other common lights, so of course there is carbon in what they are all made of."

"So carbon is smoke, eh! and light is owing to your carbon. Giving light out of smoke, eh! as they say in the classics," observed Mr Bagges.

"But what becomes of the candle," pursued Harry, "as it burns away? where does it go?"

"Nowhere," said his mamma, "I should think. It burns to nothing."

"Oh dear, no!" said Harry; "every thing—everybody goes somewhere."

"Eh? rather an important consideration that," Mr Bagges moralised.

"You can see it goes into smoke, which makes soot for one thing," said Harry. "There are other things it goes into, not to be seen by only looking, but you can get to see them by taking the right means: just put your hand over the candle, uncle."

"Thank you, young gentleman, I would rather be excused."

"Not close enough down to burn you, uncle; higher up. There; you feel a stream of hot air, so something seems to rise from the candle. Suppose you were to put a very long, slender gas-burner over the flame, and let the flame burn just within the end of it, as if it were a chimney, some of the hot steam would go up and come out at the top, but a sort of dew would be left behind in the glass chimney, if the chimney was cold enough when you put it on. There are ways of collecting this sort of dew, and when it is collected it turns out to be really water. I am not joking, uncle. Water is one of the things which the candle turns into in burning—water coming out of fire. In some lighthouses, Professor Faraday says, they burn up two gallons of oil in a night; and if the windows are cold, the steam from the oil clouds the inside of the windows, and in frosty weather freezes into ice."

"Water out of a candle, eh!" exclaimed Mr Bagges. "As hard to get, I should have thought, as blood out of a post. Where does it come from?"

"Part from the wax, and part from the air; and yet not a drop of it comes either from the air or the wax. What do you make of that, uncle?"

"Eh? oh! I'm no hand at riddles. Give it up."

"No riddle at all, uncle. That which comes from the wax is a gas called hydrogen. We can obtain it from water by passing the steam of boiling water through a red-hot gun-barrel which contains a quantity of iron wire or turnings, and change them to rust; and the other part, which comes out of the end of the barrel, will be hydrogen gas, and this part of the water we can set on fire."

"Eh?" cried Mr Bagges. "Upon my word! One of these days we shall have you setting the river on fire."

"Nothing more easy," said Harry. "When pure hydrogen burns, we get nothing but water. I would like to show you how light this hydrogen is; and I wish I had a small balloon to fill with it and make it go up to the ceiling, or a bagpipe full of it to blow soap-bubbles with, and show how much faster they rise than common ones blown with the breath."

"So do I," interposed Master Tom.

"And so," resumed Harry, "hydrogen, you know, uncle, is part of water, and just one ninth part."

' As hydrogen is to water, so is a tailor to an ordinary individual, eh ? " Mr Bagges remarked.

"Well, now, then, uncle, if hydrogen is the tailor's part of the water, what are the other parts?"

"There must be eight of them, to be sure."

"Good again, uncle; and these eight parts are a gas also, that is called oxygen. This is a very curious gas. It won't burn in air at all itself, like gas from a lamp, but it has a wonderful power of making things burn that are lighted and put into it. A lighted candle put into a jar of oxygen blazes up directly, and is consumed before you can say Jack Robinson. Charcoal burns away in it as fast, with beautiful bright sparks; phosphorus with a light that dazzles you to look at; and a piece of iron or steel, just made red-hot at the end first, is burned in oxygen quicker than a stick would be in common air. The experiment of burning things in oxygen beats any fireworks."

"How funny that must be!" exclaimed Tom.

"Now we see, uncle," Harry continued, "that water is hydrogen and oxygen united together; that water is got wherever hydrogen is burned in common air; that a candle won't burn without air; and that, when a candle burns, there is hydrogen in it burning and forming water. Now, then, where does the hydrogen of the candle get the oxygen from to turn into water with it?"

"From the air, eh?"

"Just so. It is the oxygen in the air that makes things burn; but if the air were nothing but oxygen, a candle would not last above a minute."

"What a tallow-chandler's bill we should have!" remarked Mrs Wilkinson.

"'If a house were on fire in oxygen,' as Professor Faraday said, 'every iron bar, or, rather, every pillar, every nail and iron tool, and the fireplace itself; all the zinc and copper roofs, and leaden coverings, and gutters, and pipes, would consume and burn, increasing the combustion.'"

"That would be, indeed, burning 'like a house on fire,'" observed Mr Bagges.

"But there is another gas, called nitrogen," said Harry, "which is mixed with the air, and it is this which prevents a candle from burning out too fast."

"Eh?" said Mr Bagges. "Well, I will say I do think we are under considerable obligations to nitrogen."

"I have explained to you, uncle," pursued Harry, "how a candle, in burning, turns into water. But it turns into something else besides that. The little bits of carbon that I told you about, which are burned in the flame of a candle, and which make the flame bright, mingle with the oxygen in burning, and form still another gas, called carbonic acid gas, which is so destructive of life when we breath it. So you see that a candle flame is vapour burning, and that the vapour, in burning, turns into water and carbonic acid gas."

"Haven't you pretty nearly come to your candle's end?" said Mr Wilkinson.

"Nearly. I only want to tell uncle that the burning of a candle is almost exactly like our breathing. Breathing is consuming oxygen, only not so fast as burning. In breathing we throw out water in vapour and carbonic acid from our lungs, and take oxygen in. Oxygen is as necessary to support the life of the body as it is to keep up the flame of a candle."

"So," said Mr Bagges, "man is a candle, eh? and Shakespeare knew that, I suppose, (as he did most things,) when he wrote,

'Out, out, brief candle!'

Well, well; we old ones are moulds, and you young squires are dips and rush-lights, eh? Any more to tell us about the candle?"

"I could tell you a great deal more about oxygen, and hydrogen, and carbon, and water, and breathing, that Professor Faraday said, if I had time; but you should go and hear him yourself, uncle."

"Eh? well, I think I will. Some of us seniors may learn something from a juvenile lecture, at any rate, if given by a Faraday. And now, my boy, I will tell you what," added Mr Bagges, "I am very glad to find you so fond of study and science; and you deserve to be encouraged; and so I'll give you a—what-d'ye-call-it? a galvanic battery on your next birthday; and so much for your teaching your old uncle the chemistry of a candle."

Adapted from Household Words.

COMPOSITION OF SOILS.

Soils adapted to the growth of plants consist of two principal portions—the organic and the inorganic. The organic portion or *humus*, as it is sometimes called, from a Latin word meaning *moist earth*, consists of the decayed remains of animal and vegetable matter, and varies greatly in quantity in different soils. In peaty soils it forms from 50 to 70 per cent. of the whole weight. In rich and long cultivated soils, it has been known to amount to 25 per cent.; but in general the proportion is much smaller. Oats and rye will grow on a soil which contains only $1\frac{1}{2}$ per cent. of humus; barley will flourish with only 2 to 3 per cent; good wheat soils require from 4 to 8 per cent. In stiff clayey soils, from 10 to 12 per cent. have been found.

Now it must not be supposed that a soil is fertile in proportion as it is rich in humus. Humus supplies plants with food in the form of carbonic acid by the roots; dissolved in water, humus acts injuriously; a very small quantity imparts to water a yellow or brown colour, a state in which manures cease to be beneficial to cultivated plants, because this colouring matter indicates a deficiency of oxygen to complete the conversion of the humus into carbonic acid. In a soil impregnated with this matter in solution, the roots of plants are deprived of oxygen, without which they cannot exist; for a similar reason, the stagnant water of a marshy soil excludes air; but if the marsh be thoroughly drained, so as to admit the air freely, a fruitful meadow takes its place.

The inorganic portion of the soil consists of two subdivisions, the *soluble saline* portion, from which the plant obtains nearly all the saline ingredients contained in the ash, and the *insoluble earthy* portion, which forms the great bulk of most soils, being rarely less than 95 lbs. in a hundred of their whole weight.

This earthy constituent consists of three main ingredients:—1, *Silica*, in the form of *sand*; 2, *Alumina*, mixed or combined with sand, as *clay*; and 3, *Lime*, in the form of carbonate, as chalk, limestone, &c. Soils are named according to the proportions in which these three ingredients are mingled together. According to Johnston, 100 grains of dry ordinary soil, containing only 10 of clay, would form a *sandy soil;* if it contained from 10 to 40 grains of clay, it would make a *sandy loam;* from 40 to 70, a *loamy soil;* from 70 to 85, a *clay loam;* from 85 to 95, a *strong clay* fit for making tiles and bricks; if it contain no sand, it would be pure agricultural clay or pipe-clay. With respect to alumina, it rarely happens that arable land (land fit for the plough,) contains more than from 30 to 35 per cent. of that substance. If a soil contain more than 5 per cent. of carbonate of lime, it is called a *marl;* if more than 20 per cent., *a calcareous soil.* Oxide of iron forms 2 or 3 per cent. of sand soils, and in red soils much more.

The sand, lime, clay, oxide of iron, and organic matters mingled in various proportions, give rise to soils of various colours. In chalk districts the soil is white, in the coal fields the land is black; in the central part of England dark-red soil prevails; in other districts, the prevailing character of the soil is derived from yellow, white, and brown sands and clays.

The subsoil is of variable character; in some places consisting of porous sand or gravel; in others a light loam; in a third a stiff clay. On removing the soil we get to the solid rock, such as sandstone, limestone, slate-clay, &c. All kinds of rock by their disintegration will furnish either sandstone, limestone, or clays of different degrees of hardness, or a mixture of two or more of these in different proportions. By the action of winds, rain, and frost, rocks become disintegrated at the surface, seeds get deposited by means of winds, waters, and sometimes animals, and a soil slowly accumulates, partaking necessarily of the chemical character of the rock on which it rests. Thus, on a sandstone rock the soil is sandy; on a claystone, it is more or less a stiff clay; on limestone, it is more or less calcareous; and if the rock be a mixture of these, a similar mixture will be observed in the soil formed by its crumbling. Geology has furnished the important observation, that if the soil be bad on each of two contiguous rocks, it is generally of better quality at the place where the two rocks meet. Thus, where the plastic clay comes in contact with the top of the chalk, there is much better soil than either on the clay or on the chalk; so also where the chalk and the upper green sand mingle, there are fertile patches celebrated for their wheat crops, in the production of which the phosphates in the marls are supposed to have an influence.

—WEALE.

MEN OF SCIENCE.

SIR HUMPHREY DAVY, when an apothecary's apprentice, performed his first experiments with instruments of the rudest description. He extemporised the greatest part of them himself, out of the motley materials which chance threw in his way. The pots and pans of the kitchen, and the phials and vessels of his master's surgery, were remorselessly put in requisition. It happened that a French vessel was wrecked off the Land's End, and the surgeon escaped, bearing with him his case of instruments, among which was an old-fashioned glyster apparatus; this article he presented to Davy, with whom he had become acquainted. The apothecary's apprentice received it with great exultation, and forthwith employed it as a part of a pneumatic apparatus which he contrived, afterward using it to perform the duties of an air-pump in one of his experiments on the nature and sources of heat.

In like manner, Professor Faraday, Sir Humphrey Davy's scientific successor, made his first experiments in electricity by means of an old bottle, while he was still a working bookbinder. And it is a curious fact that Faraday was first attracted to the study of chemistry by hearing one of Sir Humphrey Davy's lectures on the subject at the Royal Institution. A gentleman, who was a member, calling one day at the shop where Faraday was employed in binding books, found him poring over the article "Electricity" in an Encyclopedia placed in his hands to bind. The gentleman having made inquiries, found he was curious about such subjects, and gave him an order of admission to the Royal Institution, where he attended a course of four lectures delivered by Sir Humphrey. He took notes of the lectures, which he showed to the lecturer, who acknowledged their scientific accuracy, and was surprised when informed of the humble position of the reporter. Faraday then expressed his desire to devote himself to the prosecution of chemical studies, from which Sir Humphrey at first endeavoured to dissuade him; but the young man persisting, he was at length taken into the Royal Institution as an assistant; and eventually the mantle of the brilliant apothecary's boy fell upon the worthy shoulders of the equally brilliant bookbinder's apprentice.

The words which Davy entered in his note-book, when about twenty years of age, working away in Dr Beddoes' laboratory at Bristol, were eminently characteristic of him:—"I have neither riches nor power, nor birth to recommend me, yet, if I live, I trust I shall not be of less service to mankind and my friends than if I had been born with all these advantages." Davy possessed the capability, as Faraday does, of devoting all the powers of his mind to the practical and experimental investigation of a subject in all its bearings; and such a mind will rarely fail, by dint of mere industry and patient thinking, in producing results of the highest order. Coleridge said of Davy, "There is an energy and elasticity in his mind which enables him to seize on and analyse all questions, pushing them to their legitimate consequences. Every subject in Davy's mind has the principle of vitality. Living thoughts spring up like turf under his feet." Davy, on his part, said of Coleridge, whose abilities he greatly admired, "With the most exalted genius, enlarged views, sensitive heart, and enlightened mind, he will be the victim of a want of order, precision, and regularity."

Cuvier, when a youth, was one day strolling along the sands near Fiquamville, in Normandy, when he observed a cuttle-fish lying stranded on the beach. He was attracted by the curious object, took it home to dissect, and began the study of the mollusca, which ended in his becoming one of the greatest among natural historians. In like manner, Hugh Miller's curiosity was excited by the remarkable traces of extinct sea animals in the old red sandstone on which he worked as a quarryman. He inquired, observed, studied, and became a geologist. "It was the necessity," said he, "which made me a quarrier, that taught me to be a geologist."

—SMILES' *Self-Help.*

FROM "THE DESERTED VILLAGE."

IN all my wanderings round this world of care,
In all my griefs—and God has given me share—
I still had hopes my latest years to crown,
Amidst these humble bowers to lay me down;
To husband out life's taper at the close,
And keep the flame from wasting by repose.
I still had hopes, (for pride attends us still,)
Amidst the swains to show my book-learned skill;
Around my fire an evening group to draw,
And tell of all I felt and all I saw.
  And, as a hare whom hounds and horns pursue,
Pants to the place from whence at first he flew,
I still had hopes, my long vexations past,
Here to return—and die at home at last!
O blest retirement! friend to life's decline!
Retreat from care, that never must be mine!
How blest is he who crowns, in shades like these,
A youth of labour with an age of ease;
Who quits a world where strong temptations try,
And since 'tis hard to combat, learns to fly.
  For him no wretch is born to work and weep,
Explore the mine or tempt the dangerous deep:

No surly porter stands in guilty state,
To spurn imploring Famine from the gate.
But on he moves to meet his latter end,
Angels around befriending virtue's friend;
Sinks to the grave with unperceived decay,
While resignation gently slopes the way;
And all his prospects brightening to the last,
His heaven commences ere the world be past!

—GOLDSMITH.

KNOWLEDGE.

"WHAT an excellent thing is knowledge!" said a sharp-looking, bustling little man to one who was much older than himself. "Knowledge is an excellent thing! Knowledge is power!" repeated he; "my boys know more at six and seven years of age than I did at twelve."

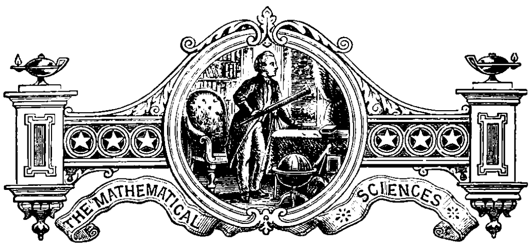
"They can read all sorts of books, and talk on all sorts of subjects. The world is a great deal wiser than it used to be. Everybody knows something of everything now. Do you not think, sir, that knowledge is an excellent thing?"

"Why, sir," replied the old man, looking gravely, "that depends entirely upon the use to which it is applied. It may be either a blessing or a curse. Knowledge is only an increase of power, and power may be a bad as well as a good thing." "That is what I cannot understand," said the bustling little man. "How can power be a bad thing?"

"I will tell you," meekly replied the old man; and thus he went on: "When the power of a horse is under restraint, the animal is useful in bearing burdens, drawing loads, and carrying his master; but when that power is unrestrained, the horse breaks his bridle, dashes his carriage to pieces, or throws his rider." "I see! I see!" said the little man.

"When the water of a pond is properly conducted by trenches, it renders the fields around fertile; but when it bursts through its banks, it sweeps everything before it, and destroys the produce of the field." "I see! I see!" said the little man; "I see!"

"When a ship is steered aright, the sail that she hoists enables her the sooner to get into port; but if steered wrong, the more sail she carries, the further she will go out of her course." "I see! I see!" said the little man; "I see clearly!"

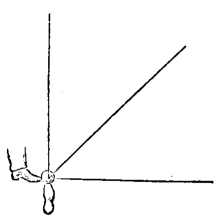


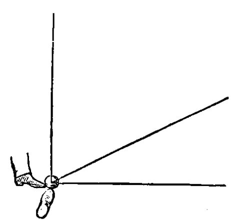
We have seen in a former lesson, that the immense variety of objects, with which a bountiful Creator has enriched and beautified the world, can be reduced to systems of knowledge under five great heads, commonly called the Natural Sciences. It is true that there exists upon our earth no substance which is not included under two of these sciences, being classed as belonging either to Geology, Botany, Zoology, or Meteorology, and also to Chemistry. But, although substance or matter is thus, as it were, exhausted, we must always remember that it alone does not make a world. As man would be nothing without mind, so would matter be actually nothing without power. It is power or force, call it what you will, that first brought together the atoms of which our earth is composed, and that still continues to hold them bound in one; it is power which makes this globe circle through the heavens on its course around the revolving sun, and that sends down to us the light and heat which that great luminary bestows: it is power, mysterious power, that excites in the atmosphere the whirlwind and the zephyr, that causes the great sea waves to toss and foam, and that brings to our ears the wonderful thing we call sound. Power, then, is not to be despised. Try to imagine a world without it. You cannot; for if there were no power added to matter, the atoms—which you will remember reading about in the paragraph on chemistry—the particles, I say, of which everything in the world consists, would have nothing to hold them together. You think, perhaps, that the millions of atoms composing the world would fly about in space. Not at all; for there would be no force to make them fly. Then they would stand still in the place where they were created. Not even that; for there would be no power to separate them from surrounding space, no force to hinder them from falling away into nothingness. There is no such thing, therefore, in this world, whatever may be the case in others, as matter unaccompanied by force. Nobody ever saw force, or felt it; it is invisible and intangible like the human mind; but, like that mind also, we can see and feel its effects daily, hourly, momentarily, at all times and in all places. It is visible in the motion of the heavenly bodies, in the ship sailing before the wind, and in the river dashing over its rocky bed. Every day that we live we feel that it dwells within us by the actions it enables us to perform; and the resistance of the solid earth, the upward growth of the flower, the many motions of the animal creation, all attest the existence of that wonderful agent,—force.

If power or force can neither be handled nor seen, how are we to describe it and its operations? How can we study it systematically as we would the objects of the Natural Sciences? What can be said about it? We cannot speak of a red or a blue, a wet or a dry, a hard or a soft force; but there is one way by which we can characterise it, and that is by quantity. We can say of a stone which is thrown only half as far as another, that it is projected with half the force of the other, or, if we are speaking of two walls of unequal strength, we may remark that it would require twice as much force to knock down the one as it would to demolish the other. Thus, we make use, in the first place, of the fraction ½, and, in the second, of the whole number 2, in describing one force as compared with another. These belong to the science of Arithmetic, a Greek word meaning *pertaining to numbers.*

At other times it is convenient to make a different kind of calculation. Suppose that two boys kick a football at the same moment, and in the same direction. We wish to know how much force each boy exerted in kicking the ball. But it might happen that we would often require to make such a calculation; and, therefore, we find a convenient form that will apply to all boys, forces, and footballs, at all times and places. We call the force of one boy's kick a, that of the other boy's b, and the distance the ball was kicked altogether c. Now we can make ever so many forms or *formulæ* (the plural of *formula*, a *form* or *model*) out of these three letters, which cannot fail to be correct, whatever the numbers may be that they stand for. Thus we can say, the force a added to, or *plus* (a Latin word meaning *more*) the force b is equal to c, the distance the ball travelled. So, if we take away the force a from c, we will know what the force b is; or if we take b from c, we will find the value of the force *a*. This we express by saying, c *minus* (a Latin word meaning *less*) the force *a*, or with *a* subtracted from it, is equal to *b*, and *c minus b* is equal to *a*. Instead of using the words *plus* and *minus*, however, we put between the letters the signs + (plus) and − (minus.) These letters and signs belong to the science of Algebra. Algebra is an Arabic word of uncertain meaning; the Arabians being the first to introduce into Europe the knowledge, which they acquired from the Hindoos, of the science that reasons about quantities by means of letters, signs, and symbols.

There is still another method of calculation which can be employed to describe a force, both as to its quantity and its direction. Suppose that our two boys were to strike the football with equal force, but in different directions; the one forward, and the other sideways. The ball would naturally go neither forward nor sideways, but exactly half-way between the two directions, making with each of them what is called an angle, thus (Fig. 1.)—





If, instead of striking with equal force, one of the boys were to hit harder than the other, the ball would go more in his direction, (Fig. 2,) thus making a smaller angle between the course in which he wishes to send it and that which it really takes, while, of course, the angle between the ball's direction and that in while the other boy wished it to go would be greater. If, therefore, we could learn the proportions of angles to one another, we could find how much greater the force of the one stroke would be than that of the other. But all this depends upon the science which deals with the measurement of lines, angles, and all figures made up of them; this science is Geometry. The word Geometry, like other names of sciences, is from the Greek, and signifies *land-measuring*,—the science of Geometry being, in early times, first applied to that purpose, which is now called the Art of Mensuration, or measuring.

We have thus seen that forces are described by Arithmetic, Algebra, and Geometry; but these are all included under one great science called Mathematics. The word Mathematics comes to us from the Greek, and may be fairly translated as *the Science*, so called, because the ancients, who were devoted to the study of it, looked upon Mathematics as the only true science and the basis or groundwork of all others. Everything belonging to form and position, quantity and number, is embraced by this science. Mathematics are of two kinds: pure, and mixed or applied. When they are called pure, it is in the same sense as we speak of water being pure, that is, without any mixture of other ingredients. Now we not only speak of 2 books, 3 lessons, 4 scholars, but of the numbers 2, 3, and 4, without referring to anything apart from the numbers themselves. In Algebra, you know that the letters *a*, *b*, *c*, &c., stand for anything at all; and in Geometry we can speak of an angle, a straight line, or a circle without alluding to any particular angle, line, or circle. Such are Pure Mathematics. But Mathematics are applied to numberless uses; to keep accounts and to measure fields, to direct the sailor in his course, and to teach the soldier how to fire a rifle or point a cannon. These, however, are not sciences, they are arts; for an art is a science put into practice. There are applications of the science of Mathematics which are sciences themselves: namely, the application of it to the many objects which nature exhibits to our gaze, and, more especially, to the description of force, that force which lives and moves in everything in the world. Thus mixed up with solids and liquids and gases, weighing the earth, sounding the sea, numbering the stars, and measuring the speed of light and sound, they are no more Pure, but become Applied Mathematics, and give birth to several systems of knowledge which may be called the Mathematical Sciences. In the following short sketch of these you will meet with little or nothing of a mathematical nature; not till you begin to study these sciences in earnest will you have to do with that system which, in many respects, deserves the title of *The Science*.

The six sciences to which Mathematics are applied are generally ranked under the one great head of Physics, from a Greek word signifying *things pertaining to nature*, or, as it is oftener called, Natural Philosophy. Natural Philosophy has to deal with the whole of Nature's wide domain, viewing it, not as a passive field for contemplation, but as a scene of restless activity, and attempting to explain the causes to which that activity is due. Endeavour, now, to grasp with your mind this wide domain; strive to include in your thoughts the earth we live upon; the sky above us, with the sun, moon, and stars shining in it; land and water; plants and animals, and the atmosphere with all that it contains. These are all composed of matter that may be seen and felt, whether it be solid matter, as stone and wood; liquid, as oil and water; or gaseous, as air and coal gas. If we regard matter as one thing, we find that the Natural World, which is to be carefully distinguished from the Spiritual World, contains but two great elements—matter and force. I have already said that we cannot see force; we can, however, see its effects. When force is applied to a body at rest, the body begins to move, and when a similar force is applied to it in an opposite direction it stops; we thus see the effects of force not only in *motion* but also in *rest*. Force is frequently called by the name of one of its effects, and in many books we see the first laws of Physics treated of under the title of Matter and Motion.

Let us enter now upon the consideration of the Mathematical Sciences, and, in order to do so aright, let us first reflect upon the two great subjects of thought, matter and motion. We look up into the heavens, and see the planets moving through space in their paths around the sun; we know, also, that our own earth revolves along with them, while the moon, wheeling round the earth, accompanies it on its course. We ask ourselves the question: what is the reason that the heavenly bodies thus move in regular order through the sky, without anything visible to support or keep them in their places? Upon this globe, the round ball which we inhabit, there are continents, seas, and islands, that constantly revolve with it in all directions, now up and now down, so that we speak of those who live upon the other side of the world as being at our antipodes, or opposite our feet. Why do not these people fall off? What hinders the earth from flying to pieces with so much whirling about? How is it that the water of oceans, lakes, and rivers, does not flow out of the world, when the parts of the earth in which these are situated are turned upside down? There are many other questions suggested by our daily experience. When we throw a stone up in the air, why does it return to the ground and not remain aloft, like the stars? How is it that a ball will not continue to roll along the ground in the same way as the stars perpetually circle round in the sky? These questions are all very important, notwithstanding that they appear so simple, and have engaged the attention of some of the greatest men that ever lived. The science which answers these and similar questions, which describes the properties or qualities of matter, and explains the laws that govern the *force* which acts upon it, is called Mechanics. Mechanics is a Greek word, and its primary, or first, signification was, *that which pertains to machines or contrivances,* because it first denoted the explanation of that power or force which man exerts upon natural objects by means of his arms, hands, and other natural or artificial machines. Now, however, it embraces all the contrivances of nature as well, and, as we have seen, is applied to the science which investigates forces and powers, and their action upon bodies, or the laws which govern matter and force. There are three kinds of matter; solid matter, such as earth, stone, wood, and flesh; fluid, as water, quicksilver, sap, and blood; and gaseous or elastic, because it contracts and expands, such as air, gas, vapour, &c. Each of these kinds of matter has a separate division of mechanics allotted to it. Thus we have three sciences instead of one; namely, mechanics of solids, mechanics of fluids, and mechanics of elastic bodies. Let us first examine the mechanics of solids. We have already learned that wherever there is matter, force is also present and acting upon it. Now, we observe that by far the greater portions of this earth, such as its mountains and rocks, the buildings which men have erected upon it, and many similar things, do not move at all. The earth certainly moves and they go along with it, but they do not alter their positions on the earth. If we set down a chair, a book, or other inanimate object, in any place, we naturally expect to find it in the same spot, unless moved by some person. But if force is constantly acting upon objects, (and we have seen that force reveals its existence by motion,) why do not these objects move? The reason simply is, that they are beset, as it were, by equal forces on every side, and are thus prevented from shifting their position. That division of the science of the mechanics of solids, which treats of solid bodies in a state of rest, and of the forces that keep them so, is called Statics, a Greek word which means *bringing to a standstill.* But solid bodies do not always stand still. The world revolves through space, snow and hail fall from the clouds, a hand-sleigh slides down a hill, and if we strike a ball it will fly forward with greater or less velocity, according to the force with which it is struck. There must, therefore, be a division of the science treating of the motions of solid bodies, and of the influence of moving bodies upon one another. This division is called Dynamics, also from the Greek, and signifying *that which pertains to power or force.*

When we turn our attention to fluids, we find that water or any other liquid, whether in seas, lakes, and rivers, or in an open vessel, such as a basin, tub, or pail, is always level on the surface, whatever inequalities may exist in the bottom or sides of that which contains it. If we take away the sides of the vessel which uphold the liquid, it will immediately give way and flow evenly over the surface of the ground, or, as it is scientifically expressed, will seek its own level. This case is very different from that of solid bodies, which are of all shapes, square and round, rough and smooth, and can stand alone, even if they are as high as the pyramids of Egypt. There must be some good reason for this, and every one who wishes to know what that reason is, will study the science of Hydrostatics, which is another Greek word equivalent to *bringing fluids to a standstill.* But this is not all we have to learn concerning fluids. We have seen already, that water moves to find its own level, whether, in order to do so, it has to spread equally over the ground, or to rise through a pipe to the distance of many feet. It can also be made to move upwards, far beyond its own level, in pumps and similar machines. Naturally, however, it moves downwards, and seeks the lowest ground. What causes these varieties of motion? To answer this question satisfactorily, you must consult some work upon the science of Hydrodynamics, or *water-power.*

There still remains another department of mechanics; namely, that which deals with gaseous or elastic bodies. This department has a name of its own, Pneumatics, which in the Greek signifies *things pertaining to air or wind.* Like the mechanics of solids and fluids, it has two divisions. The first of these treats of the properties of air at rest; such as its pressure, which is about fourteen tons' weight to a man of average size; its weight, which is from eight to nine hundred times less than that of water, and which decreases the higher we ascend in the atmosphere; its elastic nature, so plainly shown by an ordinary pop-gun; and its power of supporting other substances, as in the case of a column of quicksilver in a barometer. This division is called Aerostatics, being applied, not to air alone, but to all gaseous bodies, and bearing in Greek a meaning similar to that of Hydrostatics, merely altering the word *fluids* to *gases.* The second division deals with the motions of gases, particularly with air and its mechanical effects, such as the action of wind, exhibited in the turning of windmills, the sailing of ships, blowing down trees, dispersing clouds, and other natural and artificial employments. It sometimes encroaches upon the Science of Meteorology, which was described among the natural sciences. This part of Pneumatics is denominated Aerodynamics, or *air-power.*

Thus far we have briefly examined the three departments of mechanics with their subdivisions, in all of which the prevailing idea is that of *force*, a something that can only be described by the one great science of Mathematics. There remain no other natural objects than those included under these three departments, to which force can be applied. Whence, then, do we get our other sciences? One we find dealing with those bodies which lie beyond our atmosphere, outside of the earth; another treats of that light which all of them, but one in particular, send down to our eyes; and the third, of that application of force to our ears which we call sound.

Who has not, many a time, gazed upon the majestic, light-giving sun, the pale moon, and the countless host of stars that spangle the sky, with feelings of wonder and admiration? How often have we not asked ourselves what all these bright specks in heaven were, how far it was to them, how large they were, how they moved, and what kept them from falling out of their places? These and a thousand other questions are answered already, while the discoveries that are constantly being made by means of the telescope are satisfying even more curious inquirers than ourselves. The science which possesses so vast a domain, extending millions and millions of miles beyond this little earth, and including immense worlds and systems of worlds with which our small planet would hardly bear comparison, is that already well known to you as Astronomy. The Greek word Astronomy signifies *the law of the stars*, a law, or rather a series of laws, which could never have been discovered but for the existence of the science of Mathematics.

The sun is the great source of light to the system of which our earth forms a part. How great must that force be which sends down the cheering sunbeam through ninety-five millions of miles, in eight minutes of time, to illumine our earth! You wonder, perhaps, how men could calculate the time that such a very subtle body as light takes to travel. It is not, however, my intention to tell you in this lesson, which is only designed to stimulate your curiosity with regard to the Mathematical Sciences. All such information you will find in books written upon the science of Optics, or, as the Greek term may be translated, of *things pertaining to sight or vision*, for our eyes are the instruments with which we see and study light. This science embraces everything connected both with light in itself and our perception of it. It tells us what light is, how it moves, through what substances it will pass, and from what bodies it is reflected. It also explains the nature of all optical instruments, natural and artificial;

the eye, the telescope, the microscope, spectacles and looking-glasses. Under it also is included the wonderful phenomena or appearances which we know as *colours;* for a single white ray of light is composed of seven smaller rays, *red*, *orange*, *yellow*, *green*, *blue*, *indigo*, and *violet*, such as you have seen separated by a glass prism. This science consists of three divisions: Dioptrics, the science of light passing through any medium, as air, water, and glass; Catoptrics, the science of reflected light, as from a mirror; and Chromatics, or the science of colour. All these are Greek names appropriate to the objects of the optical sciences.

We have now arrived at the last of the Mathematical Sciences; that, namely, which investigates the nature and properties of sound. If, by means of a machine called the air-pump, we empty a glass vessel of the air which you know pervades everything, and ring a bell in the empty jar, no sound will be heard. From this it is plain that the presence of air, or some other medium, is necessary in order to constitute sound. The science of Acoustics, a Greek word meaning *things pertaining to the sense of hearing*, teaches that sound is produced in consequence of the waves excited in the atmosphere or other medium (for water will carry sound) by the moving body, such as a bell, a falling tree, or a gunshot, striking upon the ear in rapid succession. To this science belongs the whole theory of music, vocal and instrumental, with many other interesting subjects of a similar nature. Acoustics are of two kinds: Diacoustics, or the science which treats of sound conveyed through a medium, as air, water, &c.; and Catacoustics, dealing with reflected sounds, such as an echo. These words are derived, like most of those with which we have become acquainted in this lesson, from the language of the ancient Greeks, who first studied the subjects to which they are applied; and, as you will at once perceive, are analogous to those denoting two of the divisions of the science of Optics.

We have now completed our view of the Mathematical Sciences. They are not so easily understood, nor so evident to our senses, as the five Natural Sciences, but the objects with which they have to do are those we meet with every day in our lives, and which, if we be true searchers after knowledge, we will not neglect to look into. Before doing so, however, we must apply ourselves diligently to the study of Pure Mathematics, and, when we have fairly mastered their various branches, we will find their application to matter and force one of the most ennobling of pursuits and agreeable of all recreations.

The Mathematical Sciences.

I. Pure Mathematics.		
II. Mixed or Applied Mathematics, Physics, or Natural Philosophy.	Mechanics of Solids,	Statics. Dynamics.
	Do. of Fluids,	Hydrostatics. Hydrodynamics.
	Do. of Gases, or Pneumatics,	Aerostatics. Aerodynamics.
	Astronomy.	
	Optics,	Dioptrics. Catoptrics. Chromatics.
	Acoustics,	Diacoustics. Catacoustics.

MECHANICS—THE INVENTIONS OF ARCHIMEDES.

It is scarcely possible to view the vast steam-ships of our day without reflecting that to a great master of mechanics, upwards of 2000 years since, we in part owe the invention of the machine by which these mighty vessels are propelled upon the wide world of waters. This power is an application of "the Screw of Archimedes," the most celebrated of the Greek geometricians. He was born in Sicily, in the Corinthian colony of Syracuse, in the year 287 B.C., and, when a very young man, was fortunate enough to enjoy the patronage of his relative Hiero, the reigning prince of Syracuse.

The ancients attribute to Archimedes more than forty mechanical inventions—among which are the endless screw; the combination of pulleys; an hydraulic organ, according to Tertullian; a machine called the *helix*, or screw, for launching ships; and a machine called *loculus*, which appears to have consisted of forty pieces, by the putting together of which various objects could be framed, and which was used by boys as a sort of artificial memory.

Archimedes is said to have obtained the friendship and confidence of Hiero by the following incident. The king had delivered a certain weight of gold to a workman to be made into a crown. When the crown was made and sent to the king, a suspicion arose in the royal mind that the gold had been adulterated by the alloy of a baser metal, and he applied to Archimedes for his assistance in detecting the imposture: the difficulty was to measure the bulk of the crown without melting it into a regular figure; for silver being, weight for weight, of greater bulk than gold, any alloy of the former in place of an equal weight of the latter would necessarily increase the bulk of the crown; and at that time there was no known means of testing the purity of metal. Archimedes, after many unsuccessful attempts, was about to abandon the object altogether, when the following circumstance suggested to his discerning and prepared mind a train of thought which led to the solution of the difficulty. Stepping into his bath one day, as was his custom, his mind doubtless fixed on the object of his research, he chanced to observe that, the bath being full, a quantity of water of the same bulk as his body must flow over before he could immerse himself. He probably perceived that any other body of the same bulk would have raised the water equally; but that another body of the same weight, but less bulky, would not have produced so great an effect. In the words of Vitruvius, "as soon as he had hit upon this method of detection, he did not wait a moment, but jumped joyfully out of the bath, and running forthwith towards his own house, called out with a loud voice that he had found what he sought. For as he ran he called out, in Greek, Eureka! Eureka! 'I have found it out! I have found it out!'" When his emotion had sobered down, he proceeded to investigate the subject calmly. He procured two masses of metal, each of equal weight with the crown—one of gold, and the other of silver; and having filled a vessel very accurately with water, he plunged into it the silver, and marked the exact quantity of water that overflowed. He then treated the gold in the same manner, and observed that a less quantity of water overflowed than before. He next plunged the crown into the same vessel full of water, and observed that it displaced more of the fluid than the gold had done, and less than the silver; by which he inferred that the crown was neither pure gold nor pure silver, but a mixture of both. Hiero was so gratified with this result, as to declare that from that moment he could never refuse to believe anything Archimedes told him.

Travelling into Egypt, and observing the necessity of raising the water of the Nile to points which the river did not reach, as well as the difficulty of clearing the land from the periodical overflowings of the Nile, Archimedes invented for this purpose the screw which bears his name. It was likewise used as a pump to clear water from the holds of vessels; and the name of Archimedes was held in great veneration by seamen on this account. The screw may be briefly described as a long spiral with its lower extremity immersed in the water, which, rising along the channels by the revolution of the machine on its axis, is discharged at the upper extremity. When applied to the propulsion of steam-vessels, the screw is horizontal;

and, being put in motion by a steam-engine, drives the water backwards, when its reaction, or return, propels the vessel.

The mechanical ingenuity of Archimedes was next displayed in the various machines which he constructed for the defence of Syracuse during a three years' siege by the Romans. Among these inventions were catapults for throwing arrows, and balistæ for throwing masses of stone; and iron hands or hooks attached to chains, thrown to catch the prows of the enemy's vessels, and then overturn them. He is likewise stated to have set their vessels on fire by burning-glasses; this, however, rests upon modern authority, and Archimedes is rather believed to have set the ships on fire by machines for throwing lighted materials.

After the storming of Syracuse, Archimedes was killed by a Roman soldier, who did not know who he was. The soldier inquired; but the philosopher, being intent upon a problem, begged that his diagram might not be disturbed; upon which the soldier put him to death.

To Archimedes is attributed the apothegm: "Give me a lever long enough, and a prop strong enough, and with my own weight I will move the world." This arose from his knowledge of the possible effects of machinery; but however it might astonish a Greek of his day, it would now be admitted to be as theoretically possible as it is practically impossible. Archimedes would have required to move with the velocity of a cannon-ball for millions of ages to alter the position of the earth by the smallest part of an inch. In mathematical truth, however, the feat is performed by every man who leaps from the ground; for he kicks the world away when he rises, and attracts it again when he falls back.

Under the superintendence of Archimedes was built the renowned Galley for Hiero. It was constructed to half its height, by 300 master workmen and their servants, in six months. Hiero then directed that the vessel should be perfected afloat; but how to get the vast pile into the water the builders knew not, till Archimedes invented his engine called the Helix, by which, with the assistance of very few hands, he drew the ship into the sea, where it was completed in six months. The ship consumed wood enough to build sixty large galleys; it had twenty tiers of oars, and three decks; the middle deck had on each side fifteen dining apartments, besides other chambers, luxuriously furnished, and floors paved with mosaics of the story of the *Iliad.* On the upper deck were gardens with arbours of ivy and vines; and here was a temple of Venus, paved with agates, and roofed with Cyprus wood; it was richly adorned with pictures and statues, and furnished with couches and drinking vessels. Adjoining was an apartment of box-wood, with a clock in the ceiling, in imitation of the great dial at Syracuse; and here was a huge bath set with gems called Tauromenites. There were also, on each side of this deck, cabins for the marine soldiers, and twenty stables for horses; in the forecastle was a fresh-water cistern, which held 253 hogsheads; and near it was a large tank of sea-water, in which fish were kept. From the ship's sides projected ovens, kitchens, mills, and other offices, built upon beams, each supported by a carved image nine feet high. Around the deck were eight wooden towers, from each of which was raised a breastwork full of loopholes, whence an enemy might be annoyed with stones; each tower being guarded by four armed soldiers and two archers. On this upper deck was also placed the machine invented by Archimedes to fling stones of 300 pounds' weight, and darts eighteen feet long, to the distance of 120 paces; while each of the three masts had two engines for throwing stones. The ship was furnished with four anchors of wood, and eight of iron; and the "Water-Screw" of Archimedes, already mentioned, was used instead of a pump for the vast ship; by the help of which one man might easily and speedily drain out the water, though it were very deep. The whole ship's company consisted of an immense multitude, there being in the forecastle alone 600 seamen. There were placed on board her 60,000 bushels of corn, 10,000 barrels of salt fish, and 20,000 barrels of flesh, besides the provisions for her company. She was at first called the *Syracuse*, but afterwards the *Alexandria.* The builder was Archias, the Corinthian shipwright. The vessel appears to have been armed for war, and sumptuously fitted for a pleasure-yacht, yet was ultimately used to carry corn. The timber for the mainmast, after being in vain sought for in Italy, was brought from England. The dimensions are not recorded; but they must have exceeded those of any ship of the present day: indeed, Hiero, finding that none of the surrounding harbours sufficed to receive his vast ship, loaded it with corn, and presented the vessel with its cargo to Ptolemy, king of Egypt; and on arriving at Alexandria, it was hauled ashore, and nothing more is recorded respecting it. A most elaborate description of this vast ship has been preserved to us by Athenæus, and translated into English by Burchett, in his "Naval Transactions."

Archimedes has been styled the Homer of Geometry; yet it must not be concealed that he fell into the prevailing error of the ancient philosophers—that geometry was degraded by being employed to produce anything useful. "It was with difficulty," says Lord Macaulay, "that he was induced to stoop from speculation to practice. He was half ashamed of those inventions which were the wonder of hostile nations, and always spoke of them slightingly, as mere amusements, as trifles in which a mathematician might be suffered to relax his mind after an intense application to the higher parts of this science."

—TIMBS.

FAME.

AH! who can tell how hard it is to climb
The steep where Fame's proud temple shines afar;
Ah! who can tell how many a soul sublime
Has felt the influence of malignant star,
And waged with Fortune an eternal war;
Checked by the scoff of Pride, by Envy's frown,
And Poverty's unconquerable bar,
In life's low vale remote has pined alone,
Then dropped into the grave, unpitied and unknown!

And yet the languor of inglorious days
Not equally oppressive is to all;
Him, who ne'er listened to the voice of Praise,
The silence of neglect can ne'er appal.
There are, who, deaf to mad Ambition's call,
Would shrink to hear the obstreperous trump of Fame;
Supremely blest, if to their portion fall
Health, competence, and peace. Nor higher aim
Had he, whose simple tale these artless lines proclaim.

—BEATTIE.

SPRINGS AND FOUNTAINS.

THE quantity of water evaporated by the agency of heat from the broad surface of seas, lakes, and rivers, is thought to be sufficient to account for the existence of our multitudinous springs. It first hangs suspended in mid-air as invisible vapour: then, by the operation of other wonderful forces of nature, electricity, a lowering of the temperature, &c., this floating vapour becomes condensed into the perceptible forms of cloud, mist, fog, or into the sterner shapes of snow, hail, and rain. This constant precipitation is undoubtedly proportioned to the general amount of evaporation; and thus the beautifully adjusted balance between demand and supply is perfect. In order to account for the force with which natural fountains break forth and claim the name of springs, it must be remembered that if the water condensed on the surface of lofty regions finds its way through a porous soil, it may filter downward to a great depth, until it meets with some opposing barrier of impenetrable hardness. The pressure from above now becomes irresistibly great; and the water at length forces for itself a way of escape, bounding out to the surface as a sparkling and living spring.

There is one beautiful phenomenon which may here be alluded to—the "Fountain Tree" of Ferro, the most westerly of the Canary Islands. This particular island is entirely destitute of springs, and, therefore, Nature is taught by the kind Creator to supply the fatal deficiency by means of a remarkable tree which grows in a fissure of the rocks. A moisture-laden cloud is often seen hovering above the branches; these attract the vapours; they are distilled into drops, and a little series of sparkling runlets falls off from the points of the long, straight, evergreen leaves. The natives of the island constantly resort to this graceful natural fountain, just as the inhabitants of other lands flock to the springs with their empty urns, pitchers, and pails.

And now for man's share in the work. A hidden force of water has been pressing downward from a great height. It has encountered an opposition of more than common sternness. Man comes and bores a way down into the natural reservoir, and the emancipated stream quickly rises to the surface as a sober, steady *well*, or, impelled by the intense pressure from the heights, gushes eagerly forth as a leaping and glistening *fountain*. It is with this last division of our subject that we have now to deal. Men are only too glad to receive this bountiful gift from the heart of the hills, whether the fountain be one of Nature's own forming, or whether artificial aid has intervened: and various have been the contrivances both for its reception and for its guidance into the right channel. The acting principle is the same in all, that *water, flowing from a superior height through a confined channel, always seeks its own level.* The ancient Romans were not ignorant of this universal principle, which they applied to the supply of their cities with water; but they overlaid it with a cumbrous machinery, which shows that any engineer of our numerous water companies might have given the most skilful of these masters of the world an instructive lesson in hydrostatics. He would have told them that the magnificent and costly aqueduct which they were laboriously leading from the bursting urn of some fabled Naiad in the distant ravine of the purple hills was wholly unneeded, and that he could lay down such arteries beneath the "scarf-skin" of their plains as would make an abounding stream overflow the long ranges of their mosaic-paved public baths, fill every private bath in their thousand marble homes, and leap out in the sculptured fountains which often adorned the central court in their houses. That the Romans had some small foretaste of the system of conveying water by pipes is proved amid the ruins of Pompeii, where a considerable number of leaden pipes has been found, while the almost perfect remains of some of their public fountains, and even the frescoed designs upon the walls, show that the principle of the ascending tendency of water, when flowing from a higher source, was not wholly unknown to these luxurious citizens of Magna Græcia. Bronze figures have been disinterred from the buried city, which had evidently taken their part in spouting water from the ornamental fountains. In Rome there was an officer of high rank who was appointed to superintend the supply of water; and the citizens appear to have paid a high price for the privilege of having it conveyed into their houses. Agrippa is recorded to have presented to his city 105 fountains in a single year, besides 70 ponds of water, and 130 reservoirs. Even the provinces, which were remote from the capital, were endowed with splendid aqueducts and their attendant luxuries of baths and fountains; for it was the wise policy of Rome to insure the willing submission of her prostrate conquests by making the people sharers in the benefits of her own more advanced civilisation. Many of the beautiful cities of Greece were sparkling with fountains. At Corinth, a statue of Pegasus was perpetually bathing its light feet in a flow of water; and a bronze Neptune, seated on the scaly back of a dolphin, superintended a gushing fountain which spouted from the creature's mouth.

This paper may be closed by a reference to a brilliant illustration of the universal law by which water struggles to attain its own level. A great aqueduct has been made to convey a whole river of water into the city of New York. This river, the Croton, called by the Indians "The Clear Water," is dammed up at its source, forty miles from the city, and forms there a vast reservoir amid its native hills and woods. A great water-course, built of squared stones, and mounted on piers of stone-work, traverses these forty intervening miles, now striding boldly across a valley, now penetrating a hill, and again stepping bravely over a river. The channel is covered over throughout its adventurous course, and it pours "a mile and a half of fine water" into New York every hour. This is truly a Roman-like work; but now for the impromptu fountain. Just where the aqueduct steps across a valley, the engineer perforated the water-course by making an opening of about seven inches in diameter, and instantly there leaped up toward the sky a magnificent column of water, 115 feet high, forming, perhaps, the very grandest *jet d'eau* (water-spout) which has ever been beheld. The pillar of water spread itself out like a tree waved by the winds, and shivered itself into a thousand leaflets of diamond spray, shaking its glittering boughs amongst the quiet woods and the sleeping hills. —*Leisure Hour.*

THE STEAM-ENGINE.

Dr Lardner has very justly observed, that the steam-engine, as it now exists, is not the exclusive invention of any one individual. It is a combination of inventions, which, for the last two centuries, have been accumulating. The first person of whom we have any record, as having a notion of steam as a moving power, was Hero, a mathematician of Alexandria, who flourished about one hundred and thirty years before the Christian era. In a work written by him styled "Eolipyle," he describes three several methods of applying steam as a *motive* power; first, to elevate water by its elasticity; secondly, to raise water by its expansive force; and, thirdly, to produce a rotatory motion by its reaction on the atmosphere; the last only was applicable to any useful purpose. The next in order was Solomon de Caus, a Frenchman, who, in 1615, employed the elastic force of steam as a means of raising water. The third attempt to apply steam as a moving power was by Giovanni Bianca, an Italian mathematician, who formed a boiler in the shape of the human head and breast. From the mouth of the figure proceeded a pipe, through which the steam issued, and striking against the vanes of a float-wheel, similar to a common water-wheel or paddle, caused its revolution; and a pinion being attached, motion, by this means, was given to machinery, which was employed in a drug or pounding mill. The next person whose name is associated with the steam-engine is the Marquis of Worcester; who, for his loyalty to Charles the First, was, during the civil wars, imprisoned in the Tower of London. One day, according to the tradition, the lid of the pot, in which his dinner was preparing, was suddenly elevated.

Worcester pondered upon the strange phenomenon which he had witnessed. The idea then suggested itself, that the same force which had raised the cover, might become, under certain circumstances, a useful and convenient motive power. On recovering his liberty, he published, in the year 1663, in a work entitled "The Century of Inventions," a description of the uses and effects of an engine which he had constructed; and he afterwards published a small pamphlet called, "An Exact and True Definition of the most Stupendous Water-Commanding Engine." In neither of these works did he give any statement of the mode of constructing his engine; but, from his description and account of its effects, it may be inferred that its action depended on the condensation, as well as the elastic force of the steam; and, consequently, that in principle it resembled the modern steam-engine. Dr Papin, a French philosopher, then an exile in England, and a Fellow of the Royal Society of London, was the next improver of the steam-engine, by the introduction of the safety-valve for the boiler. This was in 1690.

Eight years afterwards, Captain Savery, an Englishman, introduced his engine for raising water by steam. This was, in fact, the most useful application of the power; and this discovery, like most of the rest, is said to have been made by accident. The story runs, that the captain, having partaken of too much wine, threw the wine-bottle into the fire. It happened, however, to have a small portion of wine left in it, which was immediately converted into steam by the heat. On perceiving this, he at once thought of trying what effect would be produced by immersing the neck in water, and forthwith tried the experiment; when he found that the steam which filled the flask was condensed, and that the water rushed up into the flask to supply the vacuum caused by this condensation. This casual experiment is said to have given to Savery the idea of constructing an apparatus on this plan, for raising water. It also occurred to him, that he might employ the expansive power of steam, as used in De Caus's engine. All this he effected; and, by so doing, led the way for the brilliant inventions that were afterwards made in the construction of the steam-engine. This invention was principally devoted to raising water from mines, and bore the name of the "Miners' Friend;" "but," says M. Arago, in his life of James Watt, "the miners seemed scarcely to appreciate the important compliment he paid them. With one solitary exception, none of them ordered his machines." It appeared that, with all its advantages, this engine did not perform well. In 1705, Thomas Newcomen, a smith and ironmonger, and John Crawley, a plumber and glazier, both of Dartmouth in Devonshire, took out a patent for an improved machine, which they shared with Savery. The next improvement was made by a boy named Humphrey Potter, and arose from accident. M. Arago has thus described the circumstance:—"The first machine of Newcomen required the most unremitting attention on the part of the individual who unceasingly opened and closed certain stopcocks, first for the introduction of the steam into the cylinder, and then for injecting the cold shower for its condensation. It happened, on one occasion, that the person so employed was a boy named Potter. His young companions, at their sports, uttered cries of delight, which vexed him beyond endurance. He was all impatience to join in this play; but his required duties did not allow him half-a-minute's absence; this anxiety excited his ingenuity, and led him to observe relations he had never before thought of. Of the two stopcocks, the one required to be opened at the moment that the beam (which Newcomen first and so usefully introduced into his machines) terminated the descending oscillation, and required to be closed precisely at the termination of the opposite one. The management of the other stopcock was precisely the reverse. The positions, then, of the beam, and of the stopcocks, had a necessary dependence upon each other. Potter seized upon this fact. He perceived that the beam might serve to impart to the other parts of the machine all the required movements; and on the moment he realised his conceptions. He attached a number of cords to the stopcocks, some to the one end of the handle, and some to the other, and these he attached to the most suitable parts of the beam, so that in ascending it pulled one set of cords, and in descending the other; and so effectually, that all the work of his hand was entirely superseded. For the first time, the steam-engine went by itself; and now, no other workman was seen near it but the fireman, who, from time to time, fed the furnace under the boiler. For the cords of young Potter, the engineers soon substituted rigid vertical rods, which were fixed to the beam, and armed with small pegs, which either pressed from above downwards, or from below upwards, as required, and thus turned the different stopcocks and valves. These rods themselves have since been replaced by other combinations; but, however humbling the avowal, all these expedients are nothing more than simple modifications of a contrivance suggested to a child by his desire to join in the gambols of his youthful companions."

Such was the state in which the steam-engine was found by the great James Watt, at that time a mathematical instrument maker in Glasgow. There was in the museum of the university of that city a small model of one of Newcomen's steam-engines, which was used to instruct the students at college; but which could scarcely ever be made to work satisfactorily. Professor Anderson, who then filled the chair of natural philosophy in the winter of 1763–4, requested Mr Watt to repair it, which he soon did; but in doing so, the idea was suggested to him of an improvement in the condensing of the steam, and thus causing a great saving in the expense of the engine. The general practice at that period was to condense the steam in the same cylinder in which the piston works; but this cylinder, being of cast iron, was, at every stroke, cooled nearly down to the temperature of the water employed to condense the steam, which caused a great quantity of heat to be wasted in again giving the cylinder the necessary temperature. After many trials, the fortunate thought occurred to Mr Watt, of saving all the waste of heat and fuel by condensing the steam in a separate vessel, exhausted of air, and kept cool by injection, between which and the cylinder, a communication was to be opened every time steam was to be condensed, whilst the cylinder itself was to be kept constantly hot; and having at last perfected this great improvement, (the separate vessel being called the "condenser,") a model was constructed, and the experiments made with it placed the correctness of the theory and the advantages of the invention beyond a doubt. This model has ever since been preserved among the apparatus of the university of Glasgow. His grand invention for saving steam and fuel in steam-engines was completed about the beginning of 1765; and in subsequent years he proceeded with his improvements, and introduced, among other discoveries, the rotatory motion of the sun and planet-wheels, the expansive principle, the double engine, the parallel motion, and the smokeless furnace. The application of the centrifugal regulating force of the "governor" was another of his great practical improvements; and the perfection given to the rotative-engine soon led to its general application for imparting motion to almost every species of mill-work and machinery. Thus, then, was the steam-engine completed, under the inventions, discoveries, and improvements of the great master-mind of James Watt.

Although the practicability of steam navigation was shown in France and England as early as 1730, the first genuine experiment was made on the Clyde by Messrs Miller and Symington in 1788.

The first railway for the transportation of merchandise and passengers was opened in 1825 at Darlington, George Stephenson being the engineer. —ANDERSON.

THE SONG OF STEAM.

Harness me down with your iron bands, be sure of your curb and rein,
For I scorn the power of your puny hands, as the tempest scorns a chain;
How I laughed as I lay concealed from sight, for many a countless hour,
At the childish boast of human might, and the pride of human power!

When I saw an army upon the land, a navy upon the seas,
Creeping along, a snail-like band, or waiting the wayward breeze;
When I marked the peasant faintly reel with the toil which he daily bore,
As he feebly turned at the tardy wheel, or tugged at the weary oar;

When I measured the panting courser's speed, the flight of the carrier dove,
As they bore the law a king decreed, or the lines of impatient love;
I could not but think how the world would feel, as these were outstripped afar,
When I should be bound to the rushing keel, or chained to the flying car.

Ha! ha! ha! they found me at last; they invited me forth at length,
And I rushed to my throne with thunder blast, and I laughed in my iron strength.
Oh, then ye saw a wondrous change on the earth and ocean wide,
Where now my fiery armies range, nor wait for wind or tide.

Hurrah! hurrah! the waters o'er the mountains' steep decline;
Time—space—have yielded to my power—the world! the world is mine!
The rivers the sun hath earliest blest, or those where his beams decline,
The giant streams of the queenly west, or the orient floods divine.

The ocean pales where'er I sweep, to hear my strength rejoice;
And the monsters of the briny deep cower, trembling at my voice.
I carry the wealth and the lord of earth, the thoughts of the god-like mind;
The wind lags after my flying forth, the lightning is left behind.

In the darksome depths of the fathomless mine, my tireless arm doth play,
Where the rocks never saw the sun decline, or the dawn of the glorious day.
I bring earth's glittering jewels up from the hidden cave below,
And I make the fountain's granite cup with a crystal gush o'erflow.

I blow the bellows, I forge the steel, in all the shops of trade;
I hammer the ore, and turn the wheel, when my arms of strength are made;
I manage the furnace, the mill, the mint; I carry, I spin, I weave;
And all my doings I put into print on every Saturday eve.

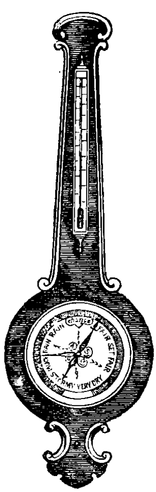
I've no muscle to weary, no breast to decay, no bones to be "laid on the shelf,"
And soon I intend you may go and play, while I manage the world by myself.
But harness me down with your iron bands, be sure of your curb and rein,
For I scorn the strength of your puny hands as the tempest scorns a chain.
—*Anon.*

THE BAROMETER.

GALILEO had found that water would rise under the piston of a pump to a height only of about thirty-four feet. His pupil, Torricelli, conceiving the happy thought, that the weight of the atmosphere might be the cause of the ascent, concluded that mercury, which is about thirteen times heavier than water, should only rise, under the same influence, to a thirteenth of the elevation—he tried, and found that this was so, and the mercurial barometer was invented. To afford further evidence that the weight of the atmosphere was the cause of the phenomenon, he afterwards carried the tube of mercury to the tops of buildings and of mountains, and found that it fell always in exact proportion to the portion of the atmosphere left below it; and he found that water-pumps in different situations varied as to sucking power, according to the same law.

It was soon afterwards discovered, by careful observation of the mercurial barometer, that even when remaining in the same place, it did not always stand at the same elevation; in other words, that the weight of atmosphere over any particular part of the earth was constantly fluctuating; a truth which, without the barometer, could never have been suspected. The observation of the instrument being carried still farther, it was found, that in serene dry weather the mercury generally stood high, and that before and during storms and rain it fell—the instrument, therefore, might serve as a prophet of the weather, becoming a precious monitor to the husbandman or the sailor.

The reasons why the barometer falls before wind and rain will be better understood a few pages hence; but we may remark here, that when water which has been suspended in the atmosphere, and has formed a part of it, separates as rain, the weight and bulk of the mass are diminished; and that wind must occur when a sudden condensation of aeriform matter, in any situation, disturbs the equilibrium of the air, for the air around will rush towards the situation of diminished pressure.



To the husbandman the barometer is of considerable use, by aiding and correcting the prognostics of the weather which he draws from local signs familiar to him; but its great use as a weather-glass seems to be to the mariner, who roams over the whole ocean, and is often under skies and climates altogether new to him. The watchful captain of the present day, trusting to this extraordinary monitor, is frequently enabled to take in sail and to make ready for the storm, where, in former times, the dreadful visitation would have fallen upon him unprepared. The marine barometer has not yet been in general use for many years, and the author was one of a numerous crew who probably owed their preservation to its almost miraculous warnings. It was in a southern latitude. The sun had just set with a placid appearance, closing a beautiful afternoon, and the usual mirth of the evening watch was proceeding, when the captain's order came to prepare with all haste for a storm. The barometer had begun to fall with appalling rapidity. As yet, the oldest sailors had not perceived even a threatening in the sky, and were surprised at the extent and hurry of the preparations; but the required measures were not completed, when a more awful hurricane burst upon them than the most experienced had ever braved. Nothing could withstand it; the sails, already furled and closely bound to the yards, were riven away in tatters: even the bare yards and masts were in great part disabled; and at one time the whole rigging had nearly fallen by the board. Such, for a few hours, was the mingled roar of the hurricane above, of the waves around, and of the incessant peals of thunder, that no human voice could be heard, and, amid the general consternation, even the trumpet sounded in vain. In that awful night, but for the little tube of mercury which had given warning, neither the strength of the noble ship, nor the skill and energies of the commander, could have saved one man to tell the tale. On the following morning the wind was again at rest, but the ship lay upon the yet heaving waves, an unsightly wreck.

The marine barometer differs from that used on shore, in having its tube contracted in one place to a very narrow bore, so as to prevent that sudden rising and falling of the mercury, which every motion of the ship would else occasion.

Civilised Europe is now familiar with the barometer and its uses, and therefore, that Europeans may conceive the first feelings connected with it, they almost require to witness the astonishment or incredulity with which people of other parts still regard it. A Chinese, once conversing on the subject with the author, could only imagine of the barometer, that it was a gift of miraculous nature, which the God of Christians gave them in pity, to direct them in the long and perilous voyages which they undertook to unknown seas. —ARNOTT.

THE WINDS.

WIND is a sensible current in the atmosphere, produced by an alteration in the equilibrium of the air from increase of temperature. Heat is thus the principal cause of the winds. When a portion or stratum of the ambient atmosphere by any cause is heated above the temperature of that immediately superincumbent, it becomes specifically lighter, and of course ascends, while the colder air sinks downward to supply its place. The currents or winds thus produced are usually classed as constant and general, periodical and local.

The constant and general winds are the trade winds or monsoons, which prevail in the Pacific and Atlantic Oceans, and, following the declination of the sun, blow, with little intermission, six months in the year in one direction, and the other six in an opposite one; and the westerly winds, which blow almost regularly from west to east in the temperate climates.

The periodical winds are the Etesian (Greek, *annual*) and Ornithian, so named from the circumstance of birds (Greek, *ornis*, a bird) embracing the opportunity of their prevalence to migrate from one country to another. These winds blow from the south-west—the latter in the month of March, and the former towards the end of July—crossing the Mediterranean, and sweeping over Greece, Macedonia, and even Africa, in a north-east direction. Among the periodical winds may also be enumerated the sea and land breezes, which occur in the islands of the torrid zone. These winds regularly change their direction every twenty-four hours, blowing from the sea to the land during the day, when the air over the land is warmer or more rarefied than the air above the sea; and moving from the interior of the land as a centre during the night, when a reverse of aerial temperature has taken place. The local winds are those currents which are peculiar to every district, occasioned chiefly by the irregularity or mountainous nature of the surface interrupting or diverging the principal current in its range; such as those met with among the valleys and altitudes of the Alps, in the province of Dauphiné, and at the Capes of Horn and Good Hope.

TRADE WINDS OR MONSOONS.

These winds take the name of monsoon from the Malay word *mussin*, season; and that of trade-wind, from the great advantage they afford to trading vessels by their constancy. From April to October a violent south-west wind blows, accompanied with rain; and from October to April a gentle, dry, north-east breeze prevails. The change of the winds, or the "breaking up" of the monsoons, as it is called, is accompanied by storms and hurricanes. Mr Neale, in his "Narrative of a Residence at the Capital of the Kingdom of Siam," says that the monsoons in that country are hailed as blessings; but must be met with due preparation. He thus describes their commencement:—

"At length, the long-looked-for monsoon arrives, his harbingers being gloomy days, and dark, threatening clouds, mounting up one upon another; there is an occasional growl of far-off thunder, and now and then a distant flash of sheet lightning. Men and boys are now seen busily engaged on the thatched roofs of the different floating houses, pulling out a handful here, putting in fresh palm-leaves there, laying heavy stones and other weights along the edges and on the top of the roof, and getting everything in order to withstand the first outburst of the fast approaching monsoon. At last," says Mr Neale, "it does come. All the doors and windows on this side of the house have been firmly secured, and, to prevent accidents, heavy chests of drawers and other weighty substances have been placed against them; for should any of them be burst open, it would be a moral" (physical, we should think, Mr Neale?) "impossibility to shut it again before the fury of the storm abated. Everybody is on the look-out, having a back entrance open by which to retreat should the gusts of wind be overpowering. There is a tremendous rustling among the cocoa-nut and mango trees on the other side of the river; leaves and little twigs of trees are seen flying up in the air; in another second, the vessels are all lying over on their sides, as if they never meant to right again—then going violently round to the breeze, and in so doing, the tempest bursts right overhead, and rain, wind, lightning, thunder—all seem combined on destruction and devastation. The squall lasts sometimes an hour, sometimes more, and then there is a little respite. The air becomes most deliciously cool, and the sweet exhalations from the grateful earth are delightful beyond description. There is a freshness in all nature, and the heart swells with joy and gratitude towards that great beneficent Being who has looked down and remembered His creatures upon earth. Such is the commencement of the monsoon. The lull between the first squall and the regular set-in of the season is of some hours' duration, and during this lull the weather is extremely invigorating. Myriads of frogs are now heard croaking from their damp retreat, ducks become quite a nuisance, and large flocks of wild water-fowl, of every imaginable description, are flying overhead at all hours, taking an inland direction, where the lakes and the tanks will be soon full to overflowing, and will afford shelter and food to them for several weeks to come."

OCCASIONAL WINDS.

The winds which are called occasional, present some remarkable phenomena. They are the hurricane, the whirlwind, the sirocco, harmattan, and simoom.

The hurricane is chiefly remarkable for the destructive violence of its career. It is most commonly experienced in the West Indies, on the western coast of Africa, and in the Indian Ocean. Its duration is at most a few hours only; but, in its fury, amidst incessant peals of thunder and a deluge of rain, the ocean appears uplifted from its lowest bed, forest trees are uptorn by the roots, and the most solid piles of most substantial masonry are shaken and whizzed into ruin, and the materials scattered and strewed upon the ground, like withered leaves by the autumnal winds. In the great Indian Ocean the hurricane turns back, after having rushed up from Borneo or Sumatra towards the coast of Madagascar, and expends its returning gyrations over the southern Australian seas. In the West Indian seas, on the other hand, the tornado arriving from the African side of the Atlantic, sweeps into the Gulf of Florida, and coming northward and westward back on its course, goes off by the coast of the United States and the banks of Newfoundland. It is as if the giant of the storm, standing on the equator, with his back to the east, flung the aerial whirl-bat into the northern hemisphere from his left hand, and into the southern from his right.

Whirlwinds are generally preceded by a breathless stillness and a sultry heat; in an instant this calm gives place to a whirling motion, increasing every moment in rapidity and power, which draws into its vortex men and animals, trees, shrubs, &c., transporting them torn, and crushed, and fractured, to some distant locality. Those frightful moving pillars of sand, so frequently encountered in the African deserts, are a species of whirlwinds of a most pestilential character. These phenomena may be attributed to the agency of electricity. We may distinguish two kinds of them, according as the electricity has accumulated in the earth, and discharges itself into the air; or, as it is emitted from a charged cloud, exerting a powerful induction upon the surface of the earth beneath, but without exploding. In the former case, which is peculiar to land, the resulting action constitutes the whirlwind, or the pillar of sand; the different appearance of which is owing to the nature of the soil from which they rise. Whirlwinds are of most frequent occurrence in those countries which are subject to earthquakes, and dry, hot seasons, during a limited time of the year, such as the wide valley of the Mississippi. Compared with the pillars of sand, they are more terrible in their destructive energies, but they are more casual, and are generally single. Pillars of sand are confined to the deserts of Africa and Hindostan. They are individually less dangerous, but each of them may deposit a quantity of suffocating dust, forming a hillock of greater height than a man, and countless numbers may be stalking, at the same time, across the arid plain with a speed that can neither be stopped nor avoided.

"The sirocco is a periodical, warm, relaxing south or south-east wind, which generally blows in the south of Italy, in Malta, Sicily, and in Dalmatia."

"The harmattan is a very dry and noxious wind, which blows periodically from the interior of Africa towards the Atlantic Ocean."

"The simoom is a very hot, dry wind, blowing from a desert, and generally bearing along a quantity of fine sand, in Arabia, Syria, and the adjacent countries, chiefly about the time of the equinoxes."

It is still true, as when the inspired words were written, that, so far as human knowledge goes, the wind, in its minor multitudinous currents, "bloweth whither it listeth;" but the great movements of the aerial tides are as regular, though, perhaps, not as easy of explanation to the intelligence, as the tides of the sea.

—ANDERSON.

THE INQUIRY.

I.

TELL me, ye wingèd winds,
  That round my pathway roar,
Do ye not know some spot
  Where mortals weep no more?
Some lone and pleasant dell,
  Some valley in the west,
Where, free from toil and pain,
  The weary soul may rest?
The loud wind dwindled to a whisper low,
And sighed for pity as it answered—"No."

II.

Tell me, thou mighty deep,
  Whose billows round me play,
Know'st thou some favoured spot,
  Some island far away,
Where weary man may find
  The bliss for which he sighs—
Where sorrow never lives,
  And friendship never dies?

The loud waves, rolling in perpetual flow,
Stopped for a while, and sighed to answer—"No."

III.

And thou, serenest moon,
  That with such lovely face,
Dost look upon the earth
  Asleep in night's embrace,—
Tell me, in all thy round,
  Hast thou not seen some spot
Where miserable man
  Might find a happier lot?
Behind a cloud the moon withdrew in woe,
And a voice, sweet but sad, responded—"No."

IV.

Tell me, my secret soul,
  Oh, tell me, Hope and Faith!
Is there no resting-place
  From sorrow, sin, and death?
Is there no happy spot
  Where mortals may be blessed,
Where grief may find a balm,
  And weariness a rest?
Faith, Hope, and Love, best boon to mortals given,
Waved their bright wings, and whispered—"Yes,
  in Heaven."

—Charles Mackay.

ASTRONOMY—THE UNIVERSE.

Every one of my readers has, I doubt not, on some clear evening, remained in the open air until darkness came, and the bright stars shone forth in the sky. The sun, which, all day long, had diffused his radiance over earth and heaven, declined towards the west; gradually his light became milder and more feeble, and, at length, like a glowing ball, he disappeared beyond the horizon. Yet, for some time longer, his rays were visible in the sky, brilliantly colouring the bank of clouds that had gathered in the west. There they shone in varied and changing hues of purple and gold, until the fading colours died away, and, little by little, darkness overspread the heavens.

Then appeared, visible, at first, only to the observing eye, a glimmering point in the firmament, and a friendly star peered downwards through the gloom. Soon it was followed by another, and then another; not long after, the great gray vault of heaven glowed with these cheering lights, some beaming mildly, and others brightly shining down; and the longer the eye gazed upwards, the more came forth from obscurity. Meanwhile, the moon, with fiery countenance, had arisen in the east, becoming paler and brighter the higher she ascended; with her, the darkness vanished, and the weaker brilliancy of the stars appeared to fade away before the soft flood of light she poured over all.

When gazing upon such a glorious scene as this, has the question ever suggested itself to you. What are all these glowing lights, and why do they shine forth at night so brightly? To such a question, an answer will now be given you; and if you reflect upon it you will again look upon the starry heavens with different emotions, seeing in them more than mere lights to illumine the night's darkness—namely, evident signs of the omnipotence, wisdom, and goodness of the Creator.

The more easily to understand the nature of the other heavenly bodies, we must first inquire into that of our earth.

THE EARTH.

Our earth is not, as you might perhaps imagine, looking about you from any standpoint upon it, a great disk, or flat surface of circular form, upon the edge of which the hollow vault of heaven rests; for, were you to proceed to the point where the earth appears to meet the clouds, another great plain would stretch out before you, and the lower part of the vault which seems to be supported by the earth would be as far away as ever; and such would still continue to be the case, however far you might wander. Our earth, therefore, and thus this appearance is accounted for, is a great ball or sphere, everywhere covered with land and water, with mountains, valleys, and plains, seas, lakes, and rivers, and maintaining upon its surface animal and vegetable life. Wherever man may be placed, the earth is beneath and the sky above him; hence, with regard to it, we cannot make use of the terms "above" and "below."

Experience has taught us that this is actually the case; for, if a man were to start from a given point, and to continue moving in the same direction, he would eventually return to the place whence he set out, but from the opposite side. To make such a journey, however, in a straight line, now on land and now on water, would be, to say the least of it, very inconvenient; it is, therefore, performed altogether by sea, and in this manner many navigators have made the circuit of the whole earth. The first man who thus circumnavigated the globe was Magellan, a Portuguese mariner in the service of Charles V., emperor of Germany, but his most celebrated successors were three Englishmen, well known to the student of history, Drake, Anson, and Cook.

This immense ball, then, the sphere on which we live, floats in that same measureless space of which we see but a small portion in the starry heavens above us, and which, extending far away on the opposite side of our earth, is there also covered with innumerable stars. Could we raise ourselves to any one of these worlds which at night shine down upon us, this great earth of ours would appear but as a twinkling light among the countless orbs of heaven.

THE SUN.

Before we can proceed further with the description of the earth, we must first learn something concerning the sun; for these bodies stand in very intimate relationship one to the other. Many as are the heavenly bodies, none is so important to us as the sun, for he it is that chases away the darkness which would, otherwise, continually envelop us; that ushers in the rosy dawn and the clear light of day, and so enables us to enjoy the thousand beauties of nature. Without him, indeed, no living thing could exist upon the earth; for, deprived of his quickening heat, an eternal winter would reign, in which no plant could grow, and which neither man nor beast could endure.

That the sun, like our earth, is an immense sphere floating freely in space, is quite evident. It is, however, far greater in size; and the reason why he appears to our vision of such small dimensions, is his vast distance from the earth; for you must be well aware that the farther an object is from us, the smaller it appears. So great is the distance of the sun from us, that, if a loaded cannon were fired from his surface to the earth, the ball, retairing the same velocity with which it flies at the rate of 500 miles a minute, would require more than twenty-one years in order to reach us. When you consider this immense distance, it may appear wonderful, yet certainly not inconceivable, that the magnitude of the sun is such, that, were he a hollow sphere, and the earth in the centre of it, the moon, which is about 237,000 miles from the earth, could move within the sun around the earth, and the distance from the moon's orbit to the inner surface of the sun would be almost as far as from the moon to the earth. Does not the contemplation of the magnitude of one sun alone fill you with wonder and amazement at the omnipotence of God, who has brought it into being from nothing? You have yet to learn, however, that there are thousands of stars as great, and even greater, than the sun.

As experience has taught you that the sun pours forth light and heat, you may perhaps imagine that he is an immense ball of fire, upon which no living thing can exist. Astronomers, however, have discovered that light and heat do not come from the sun himself, which is an opaque body like the earth, but from a luminous atmosphere with which he is surrounded. From this atmosphere rays are sent forth, and these, falling upon the earth, are absorbed or reflected by it. Since heat is derived from the sun, it would be natural to suppose that the nearer a place is to that body, the warmer it will be; but this is not the case, for the highest mountains are invariably covered with snow. We must take into consideration two things; and first, the direction in which the rays fall. Just as a stone will make a greater impression falling perpendicularly, than if, descending obliquely, it were to glance upon an object, so the sun's rays, when they are vertical or perpendicular to the earth, are more powerful than when they strike it in a slanting direction. The higher the sun is in the heavens, and thus the farthest from us, the more vertical and powerful do his rays become; for example, it is warmer at mid-day than in the morning or evening, and in summer than in winter But, secondly, we must also consider this fact, that the atmosphere is heated, not by the direct influence of the sun's rays upon it, but by the radiation of heat from the earth, which radiation does not extend to great distances above the earth's level the warmth that it supplies to the lower parts of the world. As a further explanation of this phenomenon, I may add that the air on mountain tops is very thin or rarefied, and in air of this description heat is to a very great extent latent or hidden, or, as it might better be expressed, not called into exercise.

MOTIONS OF THE EARTH—DAYS AND SEASONS.

How does it happen that the earth, being a sphere, is lighted and warmed upon every side, and that the sun appears now higher and now lower in the heavens; or, in other words, whence have we day and night, summer and winter?

Judging by appearances you would say, that the sun moves round the earth; for in the morning we see him rise in the east, in the evening, set in the west, and the next morning come back again to the same point in the east. Nor does he retain the same positions all the year round; but, during one half of it, rises gradually higher in the heavens, and, during the other half, descends in the same proportion.

This, however, is mere deception. The sun does not move round the earth. With regard to it, he remains in the same position, and moves only upon his axis, while the earth not only revolves upon its axis, but also round the sun. This fact was discovered by the astronomers of the sixteenth century, and by them and their successors placed beyond the reach of doubt. You will easily understand this if you call to remembrance similar appearances which you have known to be deceptive. Have you ever been on board a vessel quietly gliding over the calm waters of sea, or lake, or river, or in a railway car whirling rapidly along the iron track? Looking down upon the deck of the ship or the floor of the car in which you were moving, has it not appeared to you to be perfectly motionless, and then raising your eyes to view objects upon the shore or embankment, did you not seem to see trees, fields, and houses, speeding swiftly by? So it is with regard to the earth and the sun. As everything upon the earth moves along with it, and that motion is swift and unimpeded, it escapes our observation, and we, naturally enough, imagine the motion to be in the sun.

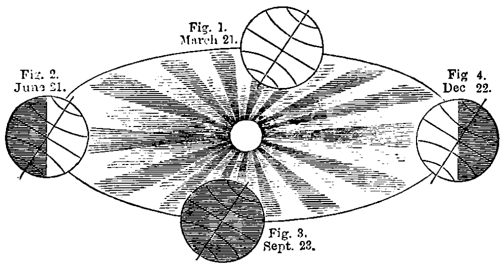
The changes of day and night, summer and winter, arise from the motion of the earth. This motion, as I have already stated, is twofold. The first is that which it performs on its own axis.

Looking upon the earth as a sphere which turns upon itself, or revolves, we can indicate two opposite points around which, as it were, this revolution takes place. These two points are called the Poles—the North and the South Pole. From one pole to the other an imaginary line is drawn, and this is called the axis of the earth. Again, we imagine another line encircling the whole earth, which is equally distant from either pole, and this is the Equator.

If the earth stood still, since we have seen that the sun does not move round it, he could only shine upon one side of the earth; the people living upon the half exposed to the sun would have day all the time, and those whose lot was cast on the other side would have perpetual night. But the wisdom and love of the Creator have planned more wisely in providing a simple means of distributing genial light and heat to all mankind. The earth is continually revolving upon its axis, and then, every hour, a part of that half of its surface which was previously turned towards the sun is withdrawn from him, and a corresponding portion of that which was averted from him is brought under the influence of his rays; in the former case, we say that the sun sets, and in the latter, that he rises. In twenty-four hours the earth completes this revolution upon its axis, and so every quarter of the globe is visited by day and night.

But all the time that the earth is revolving upon its axis, like a wheel round the axle-tree, it is also moving forward upon its great, almost circular course or orbit round the sun, just as the carriage-wheel whirls along the road. Do not imagine, however, that its progress in this direction is a slow one; it has no time for ease or leisure, since, in one year, which, as you are aware, consists of 365 days and about six hours, it must complete its whole circuit of 597,000,000 of miles. Such is the speed with which it flies forward, that in a second of time it has travelled almost nineteen miles.

If the position of the earth in its orbit were such that its axis constantly presented a perpendicular line to the sun, the middle portion of the earth would receive, the whole year round, an intense heat, before which all vegetation, great and small, would wither and die, while in the neighbourhood of the two poles, an unbroken winter would be perpetually heaping up its masses of ice and snow. For, in this position of the earth, the sun's rays would descend vertically upon the equator, but upon the poles even more slantingly. At the same time, over the whole world, day and night would each last for twelve hours; but at the two poles, the sun would only be visible upon the border of the horizon. This, however, is not the case, and very simple is the means by which refreshing coolness is brought to the hottest regions of the globe, and the coldest localities are made to enjoy the blessings of a short but warm and genial summer. As the axis of the earth never stands perpendicularly to the sun's rays, but always points in an oblique direction to the North or Pole Star, it follows that, during one half of the year, the North Pole inclines towards the sun, and during the other half of the year, the South Pole. The accompanying diagram will make this perfectly clear.



DAYS AND SEASONS.

The rays of the sun fall vertically, now upon the northern and now upon the southern hemisphere—at one time it is warmer here and at others there; seasons alternate with each other, and those of one half of the earth are always opposed to those of the other half.

In the middle part of our earth, indeed, under the equator, it is always hotter than anywhere else, and in those regions there is no such thing as a winter or cold season; while at the poles, on the other hand, frost and snow maintain a long and rigorous reign. Yet by the alternation of greater and lesser heat, of winter and summer, it is possible for men and animals to exist in nearly every quarter of the globe.

There are only two seasons in the middle part of the earth, north and south of the equator—a hot period without rain, followed by an almost uninterrupted rainy season. This part of the earth is called the Torrid Zone. North and south of it begin the Temperate Zones, in one of which we live; here there are four seasons; and still farther north and south, in the Frigid Zones, extending to the poles, there are again only two seasons—a long winter, and a short but often very warm summer.

The difference between the length of the day and that of the night in the Torrid Zone is very insignificant, being, at most, not more than two hours. Farther north and south, it becomes greater, and there are places in which, on the longest day, the sun sets but for one hour, and, on the shortest day, is visible only that length of time above the horizon. In the Frigid Zone, day lasts for weeks and months, and night equally as long, although the latter is not perfectly dark.

On the 21st of March, (see diagram, fig. 1,) such is the position of the earth with regard to the sun, that his rays fall vertically upon the equator; at that time, both with us and everywhere else, day and night are of equal duration. Although in the western parts of Europe, and in the British Islands, the snow has disappeared, and fields, gardens, and woods begin to look green and enlivening before the boisterous but temperate March gales, in our Western home winter still asserts his icy reign. The inhabitants of these countries enjoy their spring while we are looking forward to ours. But the people who dwell upon the opposite or southern side of the earth, at our antipodes, (although as the map of the world will show you there are not so many on that side as on this,) are enjoying the fruits of the soil that with us is covered with snow or chained with frost, for it is their harvest. This is called the Spring or Vernal Equinox, the latter word meaning, as you are no doubt aware, *equal night*, day and night being then of equal duration. At this time strong winds prevail.

We now pass on to the 21st of June, (see diagram, fig. 2,) when the earth, which since the 21st of March has performed a fourth of its annual journey, stands in such a position that the sun's rays fall vertically upon the part of it 1600 miles north of the equator, upon what is called the Tropic of Cancer; for so is the imaginary line named that is there drawn round the earth. By this time the short-lived flowers of spring have done flowering; the fields and woods are adorned with the varied hues of the crowfoot and columbine, the violet and geranium; and the stately forest trees, clad in their summer livery of green, rise gracefully above the pure white blossoms of the dogwood, elder, and hawthorn bushes. But while with us the grass is growing tall, and the early grain shooting—while in the orchards the trees are blooming, the fruit beginning to form, and the red strawberry is peeping between the leaves—in the southern hemisphere a different picture meets our view; for there, as you have already concluded, it is winter; here we have the longest day in the year, and there the natives are preparing for a dreary winter night; with them it is the shortest day. This is called the summer solstice, for, in it, the sun *appears* to stand still.

Three months later, and, on the 23d of September, (see diagram, fig. 3,) the sun's rays again descend vertically upon the equator, and day and night are once more equal. All nature has changed. Cool breezes begin to blow. The delicate blossoms of spring, the brighter hues of the summer flowers, give place to the more sober beauties of an endless variety of purple asters and golden rods. The harvest is over, and the stubble-fields look bare and deserted, but the woods are all aglow with mellow tints of green, purple, brown, red, and golden yellow, that shine in the autumnal sun, while the orchard trees bend down to the earth, laden with the gifts of the season. A little later and the Indian summer comes with its beautiful dreamy haze, to smooth the way to the dreary months of winter. But while with us nature is hastening to decay, the people of the southern hemisphere rejoice in the birth of spring. This is called the autumnal equinox, a time much dreaded by the sailor on the Atlantic Ocean.

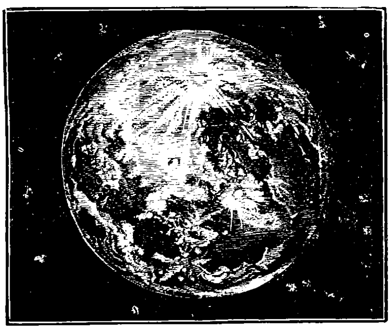
On the 22d of December, (see diagram, fig. 4,) the sun's rays fall vertically upon that portion of the earth which is 1600 miles south of the equator. The lingering relics of summer beauty that autumn had permitted to remain are now swept away. Everywhere, wood and meadowland look bleak and desolate; soon a dazzling mantle of snow and ice is cast over plain and hill, sea and lake and river, there to remain till the coming equinox shall herald the approach of spring. This season is called the winter solstice, or the sun is said to be in the Tropic of Capricorn. The 22d of December is here the shortest day, but in the other hemisphere the longest, for there it is summer.

Thus do the seasons change, each of them bringing fresh beauties and pleasures, and exhibiting proofs of the Divine goodness, that overlooks nothing, but enables all men to enjoy the heat and light of the life-giving sun, and to raise their hands in gratitude to Him by whom both sun and moon are created.

THE MOON.

Let us now cast a glance upon that near neighbour and true friend of our earth, the moon. See, there she rises in the east with pale, beaming countenance, steadfastly gazing upon the earth below as if to keep guard over it through the silent night. Gently and silently she seems to float upon the fleecy clouds, making wood and meadow, tree and shrub, shine grotesquely in the uncertain light which she pours down; the ripple on the water is bright and silvery, and all nature seems adorned with new beauties, scarcely inferior to those rich and varied ones which the sun imparts.

The moon is only some 237,000 miles distant from us, which accounts for her appearing so large, although the smallest of all the heavenly bodies visible to the naked eye; her size being little more than a fiftieth part of the earth. Yet, notwithstanding this, she is an immense ball, worthy to rank with the other members of the great celestial army, and having room enough for numberless inhabitants upon her vast surface. Her short distance has made it possible for us to observe her more closely than any of the other lights

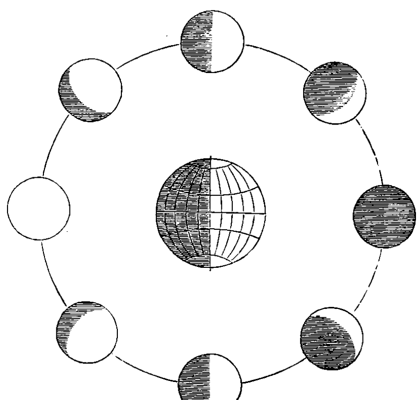


THE MOON AS SEEN THROUGH A TELESCOPE.

of heaven; and from what has been discovered by telescopes and on other grounds, astronomers have concluded that those dark and luminous portions which appear to us like a human face, are high mountains and deep valleys. By means of powerful instruments, these large mountains, some of them apparently extinct volcanoes, have been investigated, and every object 100 yards in size upon her surface has been made visible. Yet as no trace of any large building has been seen, and as she seems to possess neither sea nor atmosphere, it is hardly probable that living beings exist there. On account of her proximity also, the moon exercises much secret influence upon our earth; the ebb and flow of the tides, for example, depend upon her position with respect to us.

That the moon appears to go round the earth in *twenty-four hours* arises from the revolution of the latter, and is an optical delusion similar to that by which the sun seems to rise and set. There is, however, a considerable difference between the two cases. The moon does not remain in the same spot; whence it is evident, that she continually accompanies the earth which goes forward in its course. But she also revolves around the earth, completing this revolution in a little more than twenty-nine and a half days, at the same time moving forward with it in its course round the sun. She does not, however, like the earth, turn daily upon her own axis, but only once during her whole circuit about our globe. Hence it is that we never can see more than half of the moon. Since the moon, equally with the earth, receives light and heat from the sun, day in these far-off regions of hers lasts for half the month, and night for as long a period. During this long night, she is illumined by our earth, which, however, being so much larger, must appear to her in far greater magnificence than she to us.

If you have observed the moon at different periods, you cannot



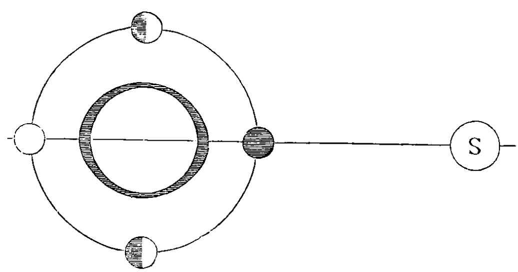
PHASES OF THE MOON.

fail to have noticed that she does not always appear in the same form. At one time—and then she is most beautiful—she exhibits a perfect disk; at another, only half the disk is visible, which decreases, day by day, until later you perceive only a narrow, shining rim, and, a few days afterwards, however clear the night or attentive your observations, you fail to discern a trace of her in the sky. These differences in the appearance of the moon are called her *changes* or *phases*, and the cause of them is to be found in her motion round the earth, so that all these different representations of the moon occur within a month, the time required to complete her orbit.

While the moon is performing her circuit round the earth, she comes, now between the sun and the earth, now sideways to it, (*you will have observed that the neuter pronoun is, in this article, applied to the earth, the feminine to the moon, and the masculine to the sun, for the sake of accurate distinction,*) and now behind it, so that the earth stands between her and the sun. In the last instance, when the earth interposes between the sun and the moon—not in a perfectly direct line, for then the earth would intercept the sun's rays and the moon would be left in darkness—the sun shines upon the side of the moon which is turned towards us, and we see all that half of the moon illumined by the sun's rays appearing like a disk, which we call the full moon. About eight days afterwards, the moon has advanced so far, that she now stands sideways to the earth; half of her surface is still illumined by the sun; but, on account of its position, we can only see the half of this half, and we call it the last quarter. In less than eight days more, the moon has half completed her course round the earth; as, in full moon, she stood behind the earth, with it between her and the sun, so now she stands in front of the earth, or between it and the sun. The side, now, which is lighted by the sun, is turned away from us, and towards us is the dark side where it is night; therefore we cannot see it, and say—it is new moon. When another week is over, the moon again stands sideways to the earth as in the last quarter, but upon the opposite side; again we see the half of the illumined side, and term it the first quarter. The first and last quarter are thus to be distinguished by being on opposite sides. Viewing the moon as something capable of being grasped, in the first quarter it may be seized with the left hand, and in the fourth with the right. The first quarter shines most in the evening, and the last quarter in the morning, for every day between one new moon and the rising of the next she makes her appearance an hour later. Let it happen, now, as is the case more or less every year, that the moon in her circuit round the earth come directly between the sun and it, or come right behind the earth; thence originate eclipses of the sun and moon. An eclipse of the sun takes place when the moon stands in a direct line between him and the earth; for now the sun's rays cannot fall upon the hemisphere which is turned towards them, since the moon intercepts them by standing between. The shadow of the moon also falls upon the earth, and we behold the sun partially or altogether obscured, the dark shade which advances before the disk of the sun being the unillumined side of the moon. It will be abundantly evident from what I have already said that such an eclipse of the sun could only occur with a new moon. Should the moon on another occasion stand in such a position as to have the earth in a direct line between her and the sun, the same thing that happens to our earth in an eclipse of the sun would befall her. The earth would now intercept the rays of the sun, and its shadow would fall upon the moon; that shadow is the black object which we see passing over her face during an eclipse of the moon. This phenomenon or appearance—for these two words mean the same thing—can only take place with a full moon.

TIDES.

I will conclude this chapter with a few words about the influence of the moon upon the tides of the ocean. The sun, but more parti-

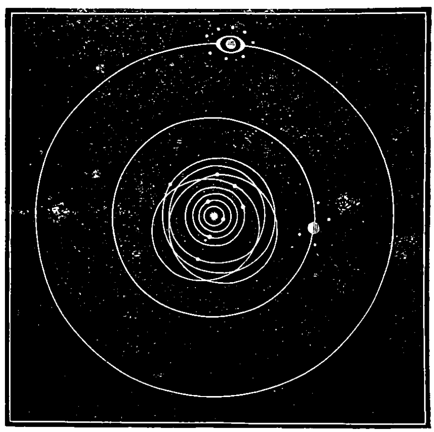


TIDES.

cularly the moon, exerts an attractive influence upon the sea, each of them raising upon it, daily, two gigantic waves which flow round the world in the same direction as that in which the sun and moon appear to move. These great waves, advancing upon the shore, come up to the limit of it, or what is called the tide-mark, and, subsiding again, leave in many places a large portion of the sea-bed near the shore denuded of water till the next great wave approaches after an interval of about twelve hours. As the moon is much nearer to the earth than the sun, her waves are about three and a-half times as large as those excited by him. One of these lunar waves, as those of the moon are called, from her Latin name, *Luna*, has its crest on that quarter of the earth's surface which is turned towards the moon, and the other, on the opposite quarter. While, on both these quarters, the tide flows in to the shore, it ebbs away from the regions that lie between them. When the sun is opposite, or in a line with the moon, this being either at the time of new or full moon, the tides are highest, and are called Spring tides, and when the moon is in her first or fourth quarter, they are at the lowest, and are denominated Neap tides; in the former case, the sun and moon act in concert, in the latter they are opposed, and thus the one serves to impair the efficiency of the other. The highest tides in the world are to be found in the Bay of Fundy, between Nova Scotia and New Brunswick, where the tide waves from the North, and from the South Atlantic Oceans meeting, raise the sea to the height of seventy-one feet. It is only in the great oceans that the moon exerts this influence; neither lakes nor small seas possess tides, the only exception being in the case of large inlets such as Hudson's Bay, which are in a position to be affected by the great tidal waves of the ocean.

THE PLANETS.

We have, so far, dealt with three of the heavenly bodies, the sun, the earth, and the moon. All three differ from one another in their size and motion, and with regard to light and heat. The sun, as we have seen, is immeasurably greater than the earth and the moon; he may be said to remain in the same place, moving only round his axis, although it has been conjectured that he, with his attendant planets, making up what is called the Solar system, is slowly moving through space towards the constellation Hercules. He possesses in himself light and heat, which he does not selfishly retain, but graciously dispenses abroad to bless and beautify all within his sphere. The sun and other similar bodies, of which, as you have yet to learn, there is a vast number, are called *fixed stars,* although many have changed their positions since they were first scientifically observed. The earth is very much smaller than the sun, and revolves both upon its own axis and around him, from whom it receives light and heat, and without whose rays it would be a cold, dark, and dismal abode. It is called a planet, or wandering star, as that word signifies. Finally, the moon has a nature very similar



THE PLANETS.

to that of the earth, but differing from it in the fact that she requires the same length of time to revolve upon her own axis as she does to move round the earth. She is called a secondary planet or satellite, from a Latin word meaning *an attendant or follower*, because of her constant companionship with the earth.

But the earth is not the only planet that "dances about the sun;" in our great aerial journey, which proceeds with such amazing rapidity, and to which we pay so little attention, we have many pleasant companions, which, in all probability, take no more notice of us than we of them: they have enough to do to attend to their course and to fly, many of them with a velocity greater than that of our earth, on their orbits through the sky. Down to the year

1864, eighty-eight such bodies have been discovered, revolving, like our earth, around the sun, and receiving from him their day and night, summer and winter. These are the planets, of which a few are larger, but by far the greater number smaller than the earth; two of them are nearer than it to the sun, the others more remote. Those nearest to the sun have a shorter course, and thus a shorter year than the others; while the more distant ones require a longer, and some of them a far longer, period of time than our earth in order to perform their annual circuit. The names by which the planets are designated have been taken from the deities which the ancient Greeks and Romans worshipped; and, stated in the order in which the planets that they are applied to are removed from the sun, are as follows:—Mercury, Venus, the Earth, Mars, the eighty Asteroids, which it would be tedious to name, Jupiter, Saturn, Uranus, and Neptune. Mercury is the nearest to the sun; he completes his orbit in eighty-eight days; Neptune is the farthest away, and requires 172 years to finish his course. The smallest planet is one of the asteroids lately discovered, the diameter of which is too small to admit of measurement; and Jupiter is the largest. Some of the other planets, like the earth, are attended by moons, which illumine their night; namely, Jupiter by four, first discovered by the illustrious astronomer Galileo in 1610, shortly after the invention of the telescope; Saturn by eight; Mars by six; and Neptune by at least one. In addition to its moons, Saturn is also favoured with a stupendous ring or series of rings, which seem to be increasing, or, at least, changing in number, three of them, and the rudiment of a fourth, being distinctly visible with a powerful telescope: these rings are of a fluid nature, and are supposed by some astronomers to be approaching the planet as if to unite with it. It has been suspected that Neptune possesses a similar ring, but this is nothing more than conjecture, and has received no confirmation. Of all the planets, Venus is the most easily recognised, being brightly visible in the sky shortly before sunrise and immediately after sunset; on which account she is commonly called the morning and the evening star. So brilliant is her light, that it alone sheds some radiance upon the earth. Mars, also, is not difficult to distinguish by his fiery-red aspect. The asteroids, which have all been discovered within the present century, as well as Uranus, Neptune, and frequently Mercury, are invisible to the naked eye: the asteroids, on account of their small size; Uranus and Neptune from their great distance; and Mercury, because so near to the sun that his brilliant light throws the little planet's feeble rays into the shade: a good telescope is necessary in order to find them. The asteroids are all very small, for the whole eighty together do not make up much more than one-third the mass of the earth. They lie between the orbits of Mars and Jupiter, are very eccentric in their motions, and angular in their form; hence many scientific men look upon them as the fragments of a great planet that has been literally broken to pieces a long time ago by some wonderful convulsion of nature. I must not omit to mention certain peculiarities connected with the better known among the planets. Sir David Brewster says, "Continents and oceans and green savannahs have been observed upon Mars, and the snow of his polar regions has been seen to disappear with the heat of summer." Mrs Somerville, a lady well known in the scientific world, concludes that the intensity of the sun's rays on Mercury must be above that of boiling quicksilver, and that water would boil even at its poles, unless the atmosphere were so constituted as to absorb or reflect this intense heat. According to Sir John Herschel, one of the most remarkable peculiarities of Vesta and Pallas, two of the earliest discovered asteroids, is that a man placed upon one of them could spring with ease sixty feet high, and that those enormous animals which, on the earth, require the buoyant power of water to counteract their weight, might there be denizens of the land. Finally, the density of Saturn is little more than one-eighth of that of the earth, so that the materials of which it consists must not be heavier than cork.

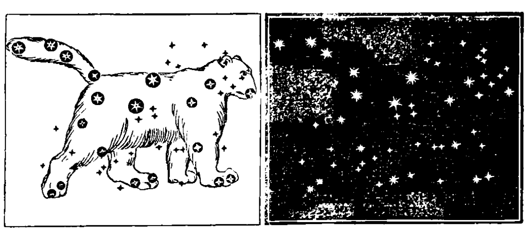
All the planets are continually changing their places in the heavens, as is especially easy of observation in those farthest removed from the sun. After a time they are seen to occupy different positions relatively, both to the sun and to one another; the reason of this it will not be hard for you to discover.

The whole of the planets taken together do not equal the sun in magnitude, and thus we recognise the law that gives order and harmony to the heavenly bodies; namely, that the smaller orbs should revolve about one great luminary, and from it receive their allotted portions of light and heat. The sun, placed in the centre, turns upon his own axis; around him revolves Mercury, next the morning or evening star, then our earth with its attendant moon, and afterwards follow in their greater orbits the other planets with their moons. This is the solar system, or the system of the sun, whose Latin name is Sol. Like a loving parent surrounded by his children, he smiles benignantly upon the circling spheres; while, looking up to him with expectancy and gratitude, they cheerfully move onwards in their path of duty, enjoying the benefits he confers upon them. Nor do they selfishly retain these gifts, but impart to one another the glory which their monarch, the orb of day, has invested them with; thus teaching a lesson of generosity to all God's rational creatures.

THE FIXED STARS.

But, you will say, what are the countless stars that at night we perceive shining in the sky, for those which we have hitherto considered are but a very small part of them? All these thousands of stars, dear reader, even the smallest that can be discerned with the eye, are fixed stars; immense bodies like our sun, and some, indeed, much larger. They may be said to remain *fixed* in their places, and thus not to alter their positions with regard to each other, although they appear, like the sun, to rise and set as our earth revolves. These light and heat-giving suns, which are so far away, that, although light travels at the amazing rate of about 200,000 miles in a second of time, it requires three years before a ray of it could reach our earth from the nearest of them, have, in all probability, their circles of planets revolving about them, and receiving from them warmth and illumination. The innumerable host of stars that bespangle the sky overhead is repeated upon the other side of the globe; and sun and earth float about in vast, unlimited space, surrounded on all sides by thousands and thousands of worlds.

On account of the amazing number of the stars, they cannot all



CONSTELLATION OF THE GREAT BEAR.

be designated by separate names. In order, however, that we may, to some extent, be able to find our way in the heavens, several stars have been taken together, and to the ninety-three groups thus formed, which are called Constellations, names have been given in accordance with their supposed resemblance to natural objects. Hence some constellations, or, as the word means, *assemblages of stars*, are distinguished by such titles as the Lion, the Goat, the Archer, the Great Bear, and the Little Bear, the Southern Cross, and the Northern Crown. Within the apparent circle of the solar system, which, you will remember, consists of the sun, and all the planets that revolve around him from Mercury to Neptune, there are twelve such constellations, and these taken together are called the Zodiac. The term zodiac is taken from a Greek word, meaning the *figure of an animal*, and is applied to this belt or circle of constellations, because most of these are supposed to represent such figures. Many of you have, no doubt, seen some very convenient, but not very elegant lines giving the names of the twelve constellations; they are as follows :—

The Ram, the Bull, the Heavenly Twins,
And next the Crab, the Lion shines,
  The Virgin and the Scales;
The Scorpion, Archer, and She-Goat,
The Man that holds the Watering Pot,
  The Fish with glittering scales.

You will remember that the apparent motion of the sun round the earth was explained by the revolution of the latter round the sun, and by its resemblance to similar deceptive phenomena. Now, by a series of like optical delusions, the sun appears, every month, to occupy a different place in the circle of constellations called the zodiac. For this reason, astronomers early divided this belt or zodiacal circle into twelve equal parts, which, with their contents, were called the Signs of the Zodiac. More than 2200 years ago, the twelve constellations named above, and the twelve divisions of the zodiac, corresponded to each other, so that when the sun was said to be in Aries or the Ram, in Cancer the Crab, or in Capricornus the Goat, it meant that he appeared to us to be in the first, fourth, or tenth division of the zodiac. But since that time, owing to a variation in the position of the pole of the earth, by which it yearly increases its distance from the north star to which it then pointed, the signs and the constellations do not correspond; nor will they again do so for 23,600 years, when the Great or Platonic year, consisting of 25,800 solar years, will be completed, and the pole of the earth will again point to the north star. The distance which the signs have retrograded, or gone backwards, is thirty-one degrees, being one degree more than the extent of a sign, so that the sign Aries or the Ram is now to be found in the constellation Pisces or the Fishes, while Taurus the Bull is in Aries, and so on.

You will be astonished at the inconceivable number of the stars, especially if you consider what an immense body each of them is. But those we perceive by the naked eye, amounting to about 8000, are by no means all. You must often have observed, on a clear evening, a broad pale shining streak extending between the stars over the whole sky. This is called the Milky Way, and, as powerful telescopes have shown, is nothing less than the glimmering of innumerable stars or suns, which Sir W. Herschel has computed to be at least 18,000,000 in number, and which are so far distant from the earth that they only yield, collectively, a pale uncertain light to the ordinary observer's gaze.

All these are what we behold from our stand-point upon this earth; but do they comprise the whole or even the greater part of creation? Who can tell what new wonders would meet our view could we but look around us from any one of those far-off stars that twinkle so feebly in the blue vault of heaven? I have used the word *twinkle* because it is a characteristic of fixed stars that they do so, and are hence easily distinguished from the planets which never present such an appearance.

The fixed stars all stand at very great distances from one another. So great are those distances that if from α Centauri,* now known to be the nearest to our earth of all the fixed stars, a railway train were to set out and move through space at the rapid rate of fifty miles an hour, it would be forty millions of years on the way before it reached us.

Sufficient, however, has already been said concerning the vast extent of the universe. What you have hitherto read about it is more, infinitely more, than the finite mind of man can comprehend or even adequately conceive.

COMETS AND METEORS.

The bodies which have, thus far, engaged our attention are well known to you, but we now come to others that are of comparatively

* The name of the constellation to which this star belongs is Centaurus or Centaur, so called after a fabulous creature in the Greek and Roman mythology, half man and half horse. The highest star in each constellation is designated by the first letter of the Greek alphabet α (alpha,) and the remaining ones, according to their brilliancy, by the succeeding letters, or by numbers if they exceed the twenty-four letters of that alphabet. Thus, α *Centauri*, means *the brightest star in the constellation of the Centaur.*

rare occurrence, and which many of you, perhaps, never beheld, namely Comets.

Comets are a very extraordinary kind of star, differing in many respects from all others. The planets and fixed stars are visible every night in the sky, or, if they do disappear now and again from our view, it is to return after regular intervals of time; but the comets, with few exceptions, are in the habit of paying short irregular visits to our sphere of vision and then rapidly vanishing from sight. The cause of this peculiarity is that their orbit is not like that of the planets, a circular or slightly oval one, in which the distance from the centre to the circumference is the same or nearly the same at all points; but an ellipse or long curved line. Neither do they revolve, like the planets, in the same direction round the sun, but in every imaginable direction over the heavens, moving apparently towards the sun, now at a great distance from him, and again approaching very closely,—one would say almost dangerously so,—to his fiery atmosphere. Their motion when approaching the sun is very rapid, one having been known to travel at the rate of 880,000 miles an hour. The length of their eccentric orbits is very various, some completing them in five, others in eighty, and others in a hundred or more years.

When a comet makes its appearance, it can, generally, be at once distinguished from all other heavenly bodies, not so much by its size, although it is stated that the one which was seen 371 years before the birth of our Saviour, and fifteen years before the birth of Alexander the Great, covered a third part of the visible heavens, but by its possessing a long and luminous appendage called a *tail.* It is from this tail that these bodies have received their name, the word comet being derived from the Greek *coma*, signifying *hair.* There have been comets, however, without tails, but they are exceptions to the general rule. These comets and the heads of other comets are supposed to consist of masses of gaseous or vaporous matter; while the tails, which are so translucent that stars have been seen through them, are set down as being composed of some much finer material of an aerial character.

We will complete our view of the starry heavens with a short inquiry into those remaining bodies of a luminous kind that from time to time visit us. You are, no doubt, all familiar with Falling Stars, called also Shooting Stars and Fireballs, but, more scientifically, Meteors. During certain months and in certain years they are very common, so that opportunities are often offered for testing the truth of the juvenile superstition that ascribes such miraculous power to a wish uttered while they are falling. They consist of gaseous matter, collected far beyond our atmosphere, and ignited or *set on fire* by some unknown cause. One of the most magnificent showers of these meteors on record occurred on the night of the 12th of November 1833, commencing at nine o'clock in the evening, and lasting without interruption till the morning sun hid them from view. This great shower fell thick as rain, covering a tract of country nearly 3000 miles wide, and extending from Canada to the northern coasts of South America. The sight is said to have been one of unequalled grandeur and sublimity, particularly in the neighbourhood of the Falls of Niagara, and to have been looked upon by many of the terrified spectators as ushering in the end of the world.

In addition to these harmless meteors, there are Aerolites or Meteoric Stones, composed of the two metals, iron and nickel. These, it has been conjectured, have been thrown up by volcanic action in the moon, and thence projected into space, through which they have wandered until brought within the attraction of our earth. Mrs Somerville, a distinguished scientific lady, mentions one which passed within twenty-five miles of us, weighing 600,000 tons, a very small fragment only of which reached the earth. Four instances, at least, are recorded of persons being killed by the fall of these meteoric stones. They have been known to fall from time immemorial in different parts of the world, and in British America there have fallen aerolites of very considerable size. Yet, strange to say, there is no trace of them to be found in the rock masses beneath our feet, among the fossil remains of former ages embedded in them,—thus proving that the visits of these erratic bodies first commenced when the earth was such as we now see it.

We have now completed our short view of the firmament above us; we have advanced to the threshold of the most instructive and elevating of all sciences, that of Astronomy. No science possesses so vast, so unlimited a domain, and there is none with which we are so imperfectly acquainted; yet in it how great, how frequent, how new and startling, are the discoveries—what fresh subjects of thought and observation are constantly suggesting themselves—and what minds are necessary to grasp its overpowering array of marvellous facts and figures! Every man and woman cannot be an astronomer like Sir William Herschel and his devoted sister Caroline, but every boy and girl ought to be able to view with intelligent and humble admiration the great wonders of creation in the heavens above us. Before this, however, can be the case, the scholar should make up his mind to acquire all the information he can concerning the heavenly bodies; should learn how great the field of knowledge is in that department, and thus, to a certain extent, be conscious of the depth of his own ignorance; and finally, he and all of us should reflect that we ourselves are but units among the many millions of this little speck in the great universe of God.

THE SUNBEAM.

Thou art no lingerer in monarch's hall;
A joy thou art, and a wealth to all;
A bearer of hope unto land and sea—
Sunbeam! what gift has the world like thee?

Thou art walking the billows, and Ocean smiles—
Thou hast touch'd with glory his thousand isles;
Thou hast lit up the ships and the feathery foam,
And gladden'd the sailor like words from home.

To the solemn depths of the forest shades,
Thou art streaming on through their green arcades,
And the quiv'ring leaves that have caught thy glow,
Like fire-flies glance to the pools below.

I look'd on the mountains—a vapour lay,
Folding their heights in its dark array;
Thou brokest forth—and the mist became
A crown and a mantle of living flame.

I look'd on the peasant's lowly cot—
Something of sadness had wrapp'd the spot;
But a gleam of *thee* on its casement fell,
And it laugh'd into beauty at that bright spell.

To the earth's wild places a guest thou art,
Flushing the waste like the rose's heart;
And thou scornest not, from thy pomp, to shed
A tender light on the ruin's head.

Thou tak'st through the dim church aisle thy way,
And its pillars from twilight flash forth to day,
And its high, pale tombs, with their trophies old,
Are bathed in a flood as of burning gold.

And thou turnest not from the humblest grave,
Where a flower to the sighing winds may wave;
Thou scatter'st its gloom like the dreams of rest,
Thou sleepest in love on its grassy breast.

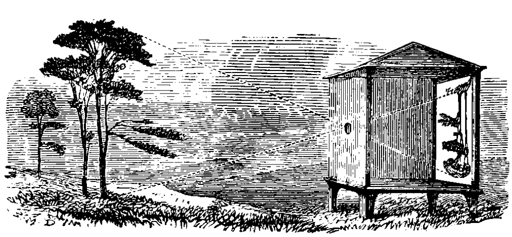
Sunbeam of summer! oh! what is like thee?
Hope of the wilderness, joy of the sea!
One thing is like thee, to mortal given,
The faith touching all things with hues of heaven.

—MRS HEMANS.

SIR WILLIAM HERSCHEL.

THE life of Sir William Herschel affords another remarkable illustration of the force of perseverance. His father was a poor German musician, who brought up his four sons to the same calling. William came over to England to seek his fortune, and he joined the band of the Durham militia, in which he played the oboe. The regiment was lying at Doncaster, where Dr Miller first became acquainted with Herschel, having heard him perform a solo on the violin in a surprising manner. The doctor entered into conversation with the youth, and was so pleased with him, that he urged him to leave the militia band, and take up his residence at his house for a time. Herschel did so, and while at Doncaster was principally occupied in violin-playing at concerts, availing himself of the advantages of Dr Miller's library to study in his leisure hours. A new organ having been built for the parish church of Halifax, an organist was advertised for, on which Herschel applied for the office, and was selected. While officiating as organist and music teacher at Halifax, he began to study mathematics, unassisted by any master. Leading the wandering life of an artist, he was next attracted to Bath, where he played in the Pump-room band, and also officiated as organist in the Octagon chapel. Some recent discoveries in astronomy having arrested his mind, and awakened in him a powerful spirit of curiosity, he sought and obtained from a friend the loan of a two-foot Gregorian telescope. So fascinated was the poor musician by the science, that he even thought of purchasing a telescope, but the price asked by the London optician was so alarming, that he determined to make one. Those who know what a reflecting telescope is, and the skill which is required to prepare the concave metallic speculum, which forms the most important part of the apparatus, will be able to form some idea of the difficulty of this undertaking.

Nevertheless, Herschel succeeded, after long and painful labour, in completing a five-foot reflector, with which he had the gratification of observing the ring and satellites of Saturn. Not satisfied with this triumph, he proceeded to make other instruments in succession, of seven, ten, and even twenty feet. In constructing the seven-foot reflector, he finished no fewer than two hundred specula before he produced one that would bear any power that was applied to it—a striking instance of the persevering laboriousness of the man. While sublimely guaging the heavens with his instruments, he continued patiently to earn his bread by piping to the fashionable frequenters of the Bath Pump-room. So eager was he in his astronomical observations, that he would steal away from the room during an interval of the performance, give a little turn to his telescope, and contentedly return to his oboe. Thus working away, Herschel discovered the Georgium Sidus, the orbit and rate of motion of which he carefully calculated, and sent the result to the Royal Society, when the humble oboe-player found himself at once elevated from obscurity to fame. He was shortly after appointed astronomer-royal, and, by the kindness of George III., was placed in a position of honourable competency for life. He bore his honours with the same meekness and humility which had distinguished him in the days of his obscurity. So gentle and patient, and withal so distinguished and successful a follower of science under difficulties, perhaps does not occur in the whole range of biography. —SMILES.



OPTICS—LIGHT.

LIGHT is the emanation from luminous or illuminated bodies which makes them visible to the eye. Some philosophers suppose it to be a subtle and extremely attenuated fluid—a real substance, yet so fine as to have no appreciable weight; and others suppose it to be merely the undulation or vibration of an ethereal medium, which is luminous when in motion, and dark when in repose. Light may be flung from one illuminated body to another, and from a second to a third; but, in every case it must come, in the first instance, from a self-luminous body. Its grand source throughout the solar system is the sun; a minor source of it, in this part of the universe, is the fixed stars; and the local sources of it in our world are principally the flashes of the electric fluid, the glow of phosphorescence, and the flame and red-heat of combustion. It is always of the same colour as the body from which it comes; it always moves in straight lines, and consists of rays, related to one another in some such way as the straws of a sheaf of corn; and it streams from every visible point of the body which emits it, and in every direction whence that point can be seen. It passes through transparent substances, whether gaseous, liquid, or solid, but is variously bent by them, or turned from the line of its previous course, according to their density and other circumstances; and it is partly absorbed and partly flung back by non-transparent bodies, in a diversity of ways, and with most gorgeous appearances, but under uniform and well-known laws. The light of the sun has been ascertained to take only seven minutes and a half to travel to the earth, or to move through a space equal to the circumference of our globe in the eighth part of a second; and all other light is presumed to travel at the same rate.

When a small sunbeam is admitted to a dark room through a little hole of a window-shutter, and projected on a white screen, or on a sheet of paper, the insertion in it of a triangular piece of glass, technically called a prism, separates it into a series of splendid colours exactly similar to those of the most perfect and brilliant rainbow. This is termed the spectrum, and comprises always the same colours in the same order. The red is at the end which is least refracted, and the violet at the other end; and if the whole be artificially divided into three hundred and sixty parts, the red will be found to occupy forty-five of these parts, the orange twenty-seven, the yellow forty-eight, the green sixty, the blue sixty, the indigo forty, and the violet eighty. When all the series, or the entire spectrum, is caught upon a lens of such a form as to concentrate it to one spot, it reproduces the white sunbeam, or original colourless light. The different colours possess different powers, and are technically regarded as different rays. The lightest green and deepest yellow are the most illuminating; and either the violet or a dark space immediately beyond it, is the most heating; and the spectrum as a whole affords ample scope for wondering inquiry and keen investigation as to its action on living organisms, on photographic preparations, and on select objects in the chemist's laboratory. The light of the moon, and various lights of combustion too, differ in their properties or actions from one another, and from the light of the sun. In all cases, however, the degree of brightness depends on the extent of the undulations, and the predominance of any ray or colour depends on their number.

The varied refraction of light in our atmosphere is the cause of twilight, and of all the tints and magnificence of landscape, cloud, and sky. Were the atmosphere awanting, or did it not possess the power of deflecting and diffusing light at a great variety of angles, and with a great variety of effects, the sun would rush up from night in a moment in the morning, and pass over the hemisphere in a uniform garish blaze through the day, and plunge back to night in a moment at sunset. This rising would resemble the sudden kindling of a bonfire by a great charge of gunpowder; his walk over the sky would resemble the steady flame of that fire, without flicker or diversity; and his setting would resemble the instantaneous extinction of it by the fall of a waterspout. He would glare in the face of observers who looked at him, but would give them no light when they turned their back to him, and would never, in any circumstances, throw illumination, or colour, or the charms of perspective, on either the outspread earth or the overarching sky. Sunshine would scarcely do more for the world, or do it much differently, than a flambeau does at midnight for a mountain glen.

"The number of objects in the heavens would, indeed, be augmented, for the stars would shine through a canopy as black as ebony, even when the sun was above the horizon; but all the gay colouring of the terrestrial landscape, which now delights the eye and the imagination, would be for ever veiled from the inhabitants of the world. In such a state of things, it would be always night, and the difference between such a night and that which we now enjoy would be, that the celestial orbs, instead of being grounded on a beautiful azure sky, would appear on a black canopy, like so many white points on a dismal mourning carpet."

Sunbeams entering the atmosphere in any other direction than the perpendicular one, but especially sunbeams entering it in a very slanting manner, as all do when the sun is far down the vault and near the horizon, undergo a long series of flexure through the various densities of gas and vapour before they reach the ground. They sustain little, indeed, in the higher regions of the air, where its density is very attenuated, and where no vapours ever exist in sufficient quantity to form a cloud; but, in struggling through the increasingly thick masses of the last two or three miles, they undergo so much as to be eventually bent almost like the segment of a hoop. Hence, as the lower end of a stick inserted in clear water appears to the eye several degrees away from what is known to be its true position, an object in the sky exactly on a line with the horizon appears to the eye to be a considerable distance above the horizon. The sun and the moon, therefore, are always visible at their rising some little time before they actually rise, and continue visible at setting some time after they actually set. And when an eclipse of the moon happens, as on rare occasions it does, exactly at the time of sunset and of moonrise, the curious spectacle is beheld of the sun in full orb on the one rim of the sky, and the moon in full orb darkened by the earth's shadow, on the other. The earth is then in the exact line between them; yet, in consequence of the refraction of the light through her atmosphere, she appears to the eye to be considerably below both.

—Rev. J. M. Wilson.

SPECTACLES; OR, HELPS TO READ.

A certain artist—I 've forgot his name—
Had got, for making spectacles, a fame,
Or "helps to read," as, when they first were sold,
Was writ upon his glaring sign in gold;
And, for all uses to be had from glass,
His were allow'd by readers to surpass.

There came a man into his shop one day—
"Are you the spectacle contriver, pray?"
"*Yes*, sir," said he, "I can in that affair
Contrive to please you, if you want a pair."
"Can you? pray do, then." So, at first, he chose
To place a *youngish* pair upon his nose;
And book produced, to see how they would fit:
Ask'd how he *liked* 'em? "Like 'em? not a bit."

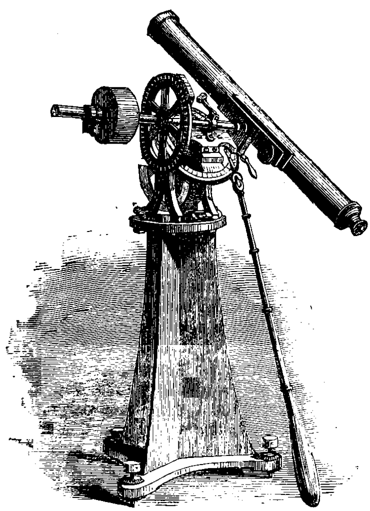
"Then, sir, I fancy, if you please to try,
These in my *hand* will better suit your eye."
"No, but they don't." "Well, come, sir, if you please,
Here is *another* sort, we'll e'en try these;
Still somewhat more they magnify the letter;
Now, sir?" "Why, now—I'm not a bit the better."
"No? here, take these, that magnify still more;
How do *they* fit?" "Like all the rest before."

In short, they tried a whole assortment through,
But all in vain, for none of 'em would do.
The operator, much surprised to find
So odd a case, thought, sure the man is blind!
"What sort of eyes can you have got?" said he.
"Why, very good ones, friend, as you may see."
"Yes, I perceive the clearness of the *ball*—
Pray, let me ask you, can you read *at all?*"
"No, you great blockhead; if I could, what need
Of paying *you* for any '*helps* to read?'"
And so he left the maker in a heat,
Resolved to post him for an arrant cheat.

—BYROM.

OPTICAL INSTRUMENTS—TELESCOPE, MICROSCOPE.

THE invention of *optical instruments* is one of the most valuable contributions which individual ingenuity has made to the general welfare. Not to mention *spectacles*, (invented, it is said, by a Florentine of the name of Salvino, in the beginning of the fourteenth century,) one of the most beneficial discoveries ever made for a large portion of mankind, let us consider the *telescope* and *microscope*. The son of a spectacle-maker of Middleburg in Holland, happening to amuse himself in his father's shop, by holding two glasses between his finger and his thumb, and varying their distance, perceived the weathercock of the church-spire opposite to him much larger than ordinary, and apparently much nearer, and turned upside down. This new wonder excited the amazement of the father; he adjusted two glasses on a board, rendering them movable at pleasure; and thus formed the first rude imitation of a perspective glass, by which distant objects are brought near to view. Galileo, a philosopher of Tuscany, hearing of the invention, set his mind to work in order to bring it to perfection. He fixed his glasses at the end of long organ-pipes, and constructed a telescope, which he soon directed to different parts of the surrounding heavens. He discovered four moons revolving round the planet Jupiter—spots on the surface of the sun, and the rotation of that globe around its axis—mountains and valleys in the moon—and numbers of fixed stars where scarcely one was visible to the naked eye. These discoveries were made about the year 1610, a short time after the first invention of the telescope. Since that period this instrument has passed through various degrees of improvement, and, by means of it, celestial won-



EQUATORIAL TELESCOPE.

ders have been explored in the distant spaces of the universe, which, in former times, were altogether concealed from mortal view.

Not less wonderful are the discoveries of the *microscope*, an instrument constructed on similar principles, for the purpose of examining minute objects. When and by whom this instrument was invented is not certainly known; though it is believed that Drebell, a Dutchman, who had one in 1621, was either the inventor or an early improver of it. By means of this optical contrivance we perceive a variety of wonders in almost every object in the animal, the vegetable, and the mineral kingdoms. We perceive, for instance, that every particle of matter, however minute, has a determinate form—that the very scales on the skin of a fish are all beautifully interwoven and variegated like pieces of network, which no art can imitate—that the points of the prickles of vegetables, though magnified a thousand times, appear as sharp and well polished as to the naked eye—that every particle of the dust on a butterfly's wing is a beautiful and regularly-organised feather—that every hair of our heads is a hollow tube, with bulbs and roots, furnished with a variety of threads or filaments—and that the pores in our skins, through which the perspiration flows, are so numerous and minute, that a grain of sand would cover a hundred and twenty-five thousand of them. We perceive animated beings in certain liquids, so small that fifty thousand of them would not equal the size of a mite; and yet each of these creatures is furnished with organs for the performance of all the animal functions required for its continued existence. In a stagnant pool, which is covered with a greenish scum during the summer months, every drop of the water is found to be a world teeming with thousands of inhabitants. The mouldy substance which usually adheres to damp bodies resembles a forest of trees and plants, where even branches, leaves, and fruit may be imagined. In a word, by this admirable instrument we behold the same Almighty hand which rounded the spacious globe on which we live and the huge masses of the planetary orbs, and directs them in their rapid motions through the sky—employed, at the same moment, in rounding and polishing ten thousand minute transparent lenses in the eye of a fly, and boring and arranging veins and arteries, and forming and clasping joints and claws for the movements of a mite. —M'CULLOCH'S *Course.*

ACOUSTICS—SOUND, HEARING, ECHO, AND MUSICAL NOTES.

SEC. 1. How does sound travel through the air? Let me try to answer this question. Imagine a row of boys standing close side by side, and that the last boy of the row stands close beside a wall or glass window. Suppose somebody to give the first boy a push in the direction of the line of boys; the first boy knocks against the second and recovers himself, the second knocks against the third, the third against the fourth, and so on, each boy recovering himself after he has sent on the push to the boy next him. The last boy of the row would be pushed up against the wall, or through the window, as the case might be.

Now, when a gun is fired, a percussion cap exploded, a bubble of explosive gas ignited, or when a peal of thunder occurs, the air at the place of explosion receives a sudden shock, and this shock is transmitted from particle to particle through the air, in a manner closely resembling the transmission of the push from boy to boy. There is a passage leading from the ear towards the brain; at a certain place a thin membrane called the tympanum is drawn across the passage, the membrane and the cavity which it stops being called the drum of the ear. Well, the air is pushed against the head of this drum, just as we have supposed the last boy of our row to be pushed against the wall or the window, only with infinitely greater rapidity. The membrane is thus thrown into motion, and this motion is communicated to the nerve of hearing. It is thus transmitted along the nerve to the brain, and there produces the sensation of sound. Nobody understands how this motion is converted into a sensation; it is one of the mysteries of life, regarding which the youngest boy who reads this page knows just as much as I do myself.

How fast does the shock travel through the air; in other words, what is the velocity of sound? The answer is, about 1100 feet a second. It travels more quickly in warm than in cold weather. Through water it travels about five times as fast as through air, and through wood it travels more than twice faster than it does through water. I once took a man and a hammer with me into Hyde Park, London, where there are very long iron rails. I placed my ear close to a rail, sent the man to a distance, and caused him to strike the rail with the hammer. For every blow he gave the rail *I heard two*, and the reason is, that the sound of each stroke travelled through the air and the iron at the same time; but through the iron it travelled with greater rapidity, and reached the ear sooner, the shock transmitted by the air arriving a little while afterwards. If the air were absent there could be no transmission of sound as at present; and where the air is very thin, as upon the tops of high mountains, the sound is much weakened. I fired a little cannon at the top of Mont Blanc last summer, and found the sound much weaker than when a similar cannon was fired on one of the Hampshire downs. This experiment was first made by the celebrated traveller, De Saussure. I may add, that sound travels just as *quickly* in thin air as in dense air; it is only the *intensity* of the sound that is affected.

Sec. 2. Let us now seek to apply the little bit of knowledge we have gained in the foregoing section. Have you ever stood close beside a man when he has fired a gun? If so, you will have seen the flash and heard the explosion at one and the same time. But if you stand at a distance from the man, you see the flash first, and hear the sound afterwards. The reason is, that while the light of the flash moves almost instantaneously, the sound requires some time to travel to your ear. Now let me ask you a question or two. Suppose you have a good watch, which informs you that the time which elapses between the flash and the sound is three seconds, at what distance would you be from the man who fires the gun? Of course you could tell me in a moment. These three seconds are the time required by the sound to travel from the man to you, and as the velocity of sound through air is 1100 feet a second, the man must be 3300 feet distant. An equally simple calculation enables you at once to tell whether a thunder-storm is dangerous or not. Each peal of thunder appears to be preceded by a flash of lightning; but if you were up in the clouds close to the place where the peal occurs, you would see the flash and hear the peal at the same moment, for they really occur together. If, therefore, a few seconds elapse between the flash and peal it is a proof that the danger is distant; but if the peal follow hot upon the flash, it shows that the danger is near. Never dread the sound; if the flash pass without injury, the subsequent peal can do no harm.

Sec. 3. I want you now to turn your thoughts for a moment to the row of boys, of which I have spoken in the first section. Suppose when the last boy is pushed up against the wall, that he, in recovering himself, pushes back against the boy next him, this second push, like the first, would propagate itself from the end to the beginning of the line of boys. In a similar way, when the pulse of air, which produces sound, strikes against a wall, it is *reflected* back, and constitutes an *echo*. The reflected wave of sound moves with exactly the same velocity as the direct one. Now, suppose a gun to be fired at a distance, 2200 feet from the side of a house or of a mountain which reflects the sound, what time will elapse between the sound and the echo? Here the sound has to travel from the gun to the wall, and back again, or a distance of 4400 feet; and as the velocity of sound is 1100 feet a second, four seconds will elapse before the echo is heard. If you reflect upon the matter, you will easily see that a wave of sound, after it has been once reflected, may strike upon a second object, which will reflect it a second time, and thus constitute a second echo. It is customary, when travelling up the Rhine, to fire a cannon at a certain place where the banks of the river rise in steep high rocks; the waves of sound are reflected several times from side to side, thus producing a perfect bubble of echoes, resembling the roll of thunder. The echoes which may be aroused in some of the mountain glens in Switzerland even by the human voice, are perfectly wonderful. I have known a valley to be filled with the wildest melody by a little boy singing the mountain *jodel* as he sat upon a rock and watched his goats.

Not only do solid bodies reflect sound in this way, but clouds do it also; and this is undoubtedly one cause of the rumbling we hear after a peal of thunder. In firing cannon, it has been observed that when the sky was clear, the sound was sharp and echoless, but that as soon as clouds appeared above the horizon, the sonorous waves striking against the clouds were reflected back again, and produced echoes. Sound is always reflected, wholly or partially, in passing from one medium to another. Even when sound passes from light to heavy air, a portion of it is reflected. This explains a singular effect, which was observed by the celebrated traveller Humboldt. Being stationed some miles distant from the great falls of the river Orinoco, in South America, he found that during the night the sound of the waterfall was so loud that he could imagine himself close beside it. During the day, the sound was much feebler. You will perhaps think that this was quite natural owing to the greater stillness of the night, but the fact was actually far otherwise. In those regions the night is far more noisy than the day. Under the noonday sun the forest beasts cease their yelling and roaring, and retire to sleep, while the innumerable swarms of insects which fill the air with their humming during the night, are all stilled. Now pay attention to the true explanation.

A large plain stretched between the place where M. de Humboldt was stationed and the waterfall, this plain being covered partially with grass, through which, however, a great number of rocks protruded. During the day these rocks became very hot—much hotter than the grass, and the consequence was, that over each rock during the day there was a column of light air—for you know that air swells and becomes light when heated, hence the sound of the waterfall in passing through the atmosphere over the plain, crossed perpetually from heavy to light, and from light to heavy air. At each passage a small portion of the sound was reflected, and this occurred so often, that before it reached the place where M. de Humboldt was stationed, the sound was greatly enfeebled. At night the rocks became cooled, there was no longer that great difference of temperature between them and the grass; the atmosphere was more homogeneous, and the sound passed through it without reflection: the consequence was that the roar of the cataract was much louder during the night than during the day.

Sec. 4. In the first section I explained to you how a single pulse of sound was transmitted through the atmosphere, and what it did in the ear. I have said that the tympanum is thrown into motion by the shock. Now, every motion in nature, when once excited, takes *time* to subside. In the case of the tympanum the motion subsides very speedily, but still it requires time; and if you cause two shocks to follow each other with sufficient speed, the last of them may reach the ear before the motion excited by the first has been extinguished, and thus a *prolonged* sound may be produced. Here I have to announce to you a most interesting fact,—*a musical sound* is a sound which is prolonged in this way. It is produced by a series of impulses which strike the ear at regular intervals, and in quick succession. In producing a musical sound, therefore, we make use of a body which is capable of sending a succession of waves to the ear,—a vibrating string or belt, a vibrating tongue, as in the Jew's harp and the concertina; a vibrating column of air, as in the flute or organ-pipe. The organs of voice are also capable of being thrown into vibration, like the reed of a clarionet, by the air passing from the lungs. But now I have to draw your attention to a peculiarity of these musical sounds or notes. They differ in *pitch*,—some notes are high and others low; and the height or pitch of the note depends solely upon *the number of impulses which the tympanum receives in a second.* The greater the number of impulses per second, the higher the note. A string which vibrates 500 times in a second, produces a higher note than one which vibrates only 400 times a second. The shorter a string is, the more quickly it vibrates, and the higher the note that it produces. In like manner, the shorter the organ-pipe or the flute—and you really shorten a flute when you take your fingers off its holes—the quicker its vibration, and the higher its note. If space permitted, I might state to you the relative lengths of the strings, or of the organ-pipes, necessary for producing all the notes of the gamut. I will content myself by saying, that when one string is half the length of another, it vibrates twice as quickly, supposing both to be screwed up equally tight, and the note it produces is *the octave* of that produced by the longer string. Thus it is that by judiciously varying the lengths of a few strings, by pressing upon them with his fingers, a violin player is able to produce a great variety of notes.

A succession of *taps*, if they only follow each other speedily enough, will produce a musical note. When a slate-pencil, held loosely in the hand and perfectly upright, is drawn along a slate, every boy knows that a jumping motion of the pencil, and a dotted line upon the slate, are produced. A series of distinct taps of the pencil is also heard, but the sound is a mere rattle. By pressing upon the pencil, these taps can be caused to succeed each other more quickly, until finally a musical note is produced. Most people, it is true, shut their ears against this melody, and complain that it gives them the toothache; but it is nevertheless a good illustration of our present subject. If a card be held against the circumference of a toothed wheel, it is struck by the teeth as they pass, and the distinct taps are heard, but if the wheel rotates rapidly enough, the separate taps are no longer distinguishable, but melt into a continuous musical note. A series of *puffs* can also produce a musical note. If a locomotive could send out its puffs quickly enough, we should have a musical sound of deafening intensity. Instruments have been made for the express purpose of producing taps or puffs, and such instruments are provided with machinery which tells us the exact number of puffs or taps accomplished in a second. By means of such instruments we can tell the exact number of vibrations produced by the organs of a singer. We have only to bring the instrument and the voice to the same pitch; the number of puffs there recorded by the instrument is the number of vibrations accomplished by the singer. In the same way the number of times a bee flaps its wings in a second can be accurately determined from the hum of the insect. In this way, indeed, it has been ascertained that gnats sometimes flap their little wings fifteen thousand times in a second!

How wonderful all this is, my boys, and how well worthy of your attention. And how beautiful does the arrangement appear, that Nature should possess such wonders, and that man should possess the power of investigating and understanding them!

—PROFESSOR TYNDALL.

THE BELLS.

Hear the sledges with their bells—
Silver bells—
What a world of merriment their melody foretells!
How they tinkle, tinkle, tinkle,
In the icy air of night,
While the stars that oversprinkle
All the heavens, seem to twinkle
With a crystalline delight;
Keeping time, time, time,
In a sort of Runic rhyme,
To the tintinnabulation that so musically wells
From the bells, bells, bells,
Bells, bells, bells—
From the jingling and the tinkling of the bells.

II.

Hear the mellow wedding-bells,
Golden bells!
What a world of happiness their harmony foretells!
Through the balmy air of night
How they ring out their delight!
From the molten-golden notes,
And all in tune,
What a liquid ditty floats
To the turtle-dove that listens, while she gloats
On the moon!
Oh, from out the sounding cells
What a gush of euphony voluminously wells!
How it swells!
How it dwells—
On the future! how it tells
Of the rapture that impels
To the swinging, and the ringing
Of the bells, bells, bells—
Of the bells, bells, bells, bells,
Bells, bells, bells—
To the rhyming and the chiming of the bells!

III.

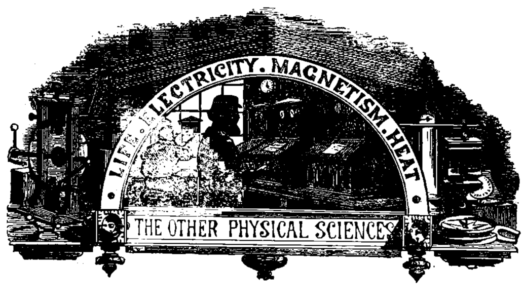
Hear the loud alarum bells—
Brazen bells!
What a tale of terror, now, their turbulency tells!
In the startled ear of night
How they scream out their affright!
Too much horrified to speak,
They can only shriek, shriek,
Out of tune,
In a clamorous appealing to the mercy of the fire,
In a mad expostulation with the deaf and frantic fire,
Leaping higher, higher, higher,
With a desperate desire,
And a resolute endeavour,
Now, now to sit or never,
By the side of the pale-faced moon.
Oh, the bells, bells, bells!
What a tale their terror tells
Of despair!
How they clang, and clash, and roar!
What a horror they outpour
On the bosom of the palpitating air!
Yet the ear it fully knows
By the twanging,
And the clanging,
How the danger ebbs and flows;
Yet the ear distinctly tells,
In the jangling,
And the wrangling,
How the danger sinks and swells,
By the sinking or the swelling in the anger of the bells—
Of the bells—
Of the bells, bells, bells, bells,
Bells, bells, bells—
In the clamour, and the clangour of the bells!

IV.

Hear the tolling of the bells—
Iron bells!
What a world of solemn thought their monody compels!

In the silence of the night,
How we shiver with affright
At the melancholy menace of their tone!
For every sound that floats
From the rust within their throats
Is a groan.
And the people—ah, the people—
They that dwell up in the steeple,
All alone,
And who tolling, tolling, tolling,
In that muffled monotone,
Feel a glory in so rolling
On the human heart a stone—
They are neither man nor woman—
They are neither brute nor human—
They are ghouls.
And their king it is who tolls;
And he rolls, rolls, rolls, rolls,
A pæan from the bells!
And his merry bosom swells
With the pæan of the bells!
And he dances and he yells;
Keeping time, time, time,
In a sort of Runic rhyme,
To the pæan of the bells—
Of the bells;
Keeping time, time, time,
In a sort of Runic rhyme,
To the throbbing of the bells—
Of the bells, bells, bells,
To the sobbing of the bells,
Keeping time, time, time,
As he knells, knells, knells,
In a happy Runic rhyme,
To the rolling of the bells—
Of the bells, bells, bells—
To the tolling of the bells,
Of the bells, bells, bells, bells—
Bells, bells, bells,
To the moaning and the groaning of the bells.

—EDGAR A. POE.



THE two groups which we have thus far considered, are those known as the Natural and Mathematical Sciences. These, together with the group that is now to be introduced to your notice, make up the large class of the Physical Sciences, so called—as you are, no doubt, aware—from a Greek word signifying *nature*, since the subjects of which they treat are natural objects and powers. This large family of the physical sciences exhausts the whole wide domain of nature, viewed not only as a collection of dull, inert matter, but as a scene of perpetual activity. We have already seen that nothing in the world consists only of dead, powerless matter; that to everything there is applied the mysterious element termed force; and that by the union of these two great principles, in an infinite variety of form, is made up the vast empire of nature. The force with which we have hitherto had to deal in connexion with the mathematical sciences, is, to a great extent, *homogeneous*, or of the same nature, whether exerted in the attraction of bodies to the earth, the raising of fluids, the diffusion of gases, the motions of the heavenly bodies, or the transmission of light and sound. But very different, in many respects, are the forces which we are now to consider; powers that the mathematician can make little of, and which the natural historian and the chemist are not sorry to erect into separate sciences. These powers, the study of which completes the circle of the physical sciences—powers mysterious in their origin, remarkable in their effects, and but recently examined with any fitting amount of attention—are *life*, *heat*, *electricity*, and *magnetism*.

Let us revert for a moment to the subjects of our first lesson on the sciences. You will remember that the objects composing the material world, or the empire of nature, are, as included under the sciences of geology, meteorology, botany, and zoology, the earth and its constituent parts, as rock masses, soils, and minerals; things in the air, as its component gases, snow and hail; and finally, plants and animals. Here, then, are four classes, the first two being essentially different from the two last. The one element which, by its presence or absence, constitutes the distinction between them is *life.* We separate the classes thus formed by calling the former, or those which constitute the subject matter of botany and zoology, *organised bodies*, as being composed of different parts or *organs*, fulfilling various functions or duties by means of the vital principle. The objects of geological and meteorological science we call *unorganised*, as consisting of similar parts, and being thus destitute of organs, and, consequently, of functions to be performed. The two great functions common to all organised bodies are those of *nutrition* and *reproduction.* Nutrition is the process by which food or nourishment, being taken into the organised body, forms substances similar to it, and thus increases the growth of the body, or supplies what is lost by wear and tear of the system. Reproduction, on the other hand, is the process by which the adult plant or animal produces young plants or animals of the same kind as itself, thus keeping up a perpetual round of life, from year to year, and from generation to generation. In addition to these functions, animals, as a rule, possess the faculties of sensation or feeling, of self-determined motion, and to a certain extent of intelligence. Thus there arises a distinction between animal and vegetable life, which is expressed by the use of the terms *animate* and *inanimate*, the former being applied to the animal, and the latter to the vegetable creation. The science that treats of this wonderful phenomenon, *life*, of the mysterious power by which beings live and grow and reproduce themselves, is called physiology. The word physiology is Greek, and means simply *a discourse about nature.* You will perceive, therefore, that it is too wide a term altogether to be applied to so limited a field; a much more appropriate title for the science would be biology, or *a discourse about life.* It is divided into two branches, animal and vegetable physiology, which should be studied in connexion with zoology and botany, their kindred sciences, in order that they may mutually illustrate one another. A comparison of organised bodies with each other, exhibiting all the steps by which we ascend from the so-called red snow of the Arctic regions, a lichen consisting of a single cell, to the giant oak, and from the minute animalcule to the king of beasts, is called comparative physiology.

The application of this science to human life, embracing a study of man's organism, and of the diseases to which it is subject, lies at the foundation of the art of medicine.

We have now to consider a power not confined to organized bodies, but universally diffused throughout nature; this power is heat. No substance is destitute of it; plants and animals, stones and metals, air, water, and even ice, possess heat. Every day the sun sends down floods of warmth upon our earth; it is evolved by the nourishment we take into our system; and in chemical union and decomposition it is always present. Friction is a fruitful agent of heat. Sir Humphrey Davy, when a student, first discovered that by rubbing together two pieces of ice, heat can be evolved from them. The Kaffirs of South Africa kindle a fire by smartly twisting a pointed stick, held vertically, in the round hole scooped out in another piece of wood placed in a horizontal position; and the phenomenon exhibited by the striking together of a flint and steel, or two fire-stones, is well known to every school-boy. You must have observed this wonderful power in a thousand different forms; in the cheerful fire, and in the terrible conflagration; in the steaming of the tea-kettle, and the speed of the railway train; in warm clothing, and the summer sun; in the effects of the burning glass, and in the red-hot bar on the blacksmith's anvil. Then, again, you have read of volcanoes and boiling springs, giving evidence of the great fires that are smouldering far beneath our feet in the centre of the globe. What is this remarkable element, the good servant and the bad master? Is it a substance like earth, and air, and water, that were classed in olden times, before chemistry enlightened the world, as its brother elements; or is it only a force, a power to act upon and alter the conditions of matter? To answer this question, and numberless as interesting ones concerning heat, you must refer to chemical works, and others written expressly upon the new science of heat, or, as it is sometimes called from a Greek word which means *pertaining to heat*, Thermotics.

Generally treated of in connexion with heat, is a subtle invisible agent, capable of producing the most marvellous effects. It annihilates time and space, bearing messages to a distance of many hundred miles in a few moments of time, like the fabled *genii* of old. It runs over continents, bridges seas, and now unites the old and new worlds in its own quiet, mysterious way. This strange power is greatly diffused in the world. We see it in the lightning that, in stormy weather, flashes across the sky, or in warm summer evenings spreads its fitful light over the horizon. The Aurora Borealis, or Northern Lights, and the bright artificial sparks from what is termed *an electric battery*, are exhibitions of this same power. A familiar instance of it is seen in the thin streaks of light that appear when the hair of a black cat is rubbed the wrong way in the dark. The power of this remarkable agent is twofold—it attracts and repels. Thus, a stick of sealing wax, rubbed smartly upon a piece of silk or the coat sleeve, will attract a piece of glass treated in a similar manner, but will repel another piece of wax. With certain substances it seems to agree, and can be conveyed through or over them without any part of it being lost, while it is, so to speak, absorbed by others. The former are called *good* conductors, among the number of which is iron, the metal of which lightning rods are made. Seven animals, all of the fish tribe, possess this power in a remarkable degree; these are three species of the torpedo, the electric eel, the Indian sword-fish, a kind of globe-fish, and another of the salmon family called silurus. It is not, however, confined to these creatures, but resides in a much smaller degree in most animals and plants, being a regular attendant of heat, under which it is generally classified. This hidden power, this mysterious agent, is called *electricity*, from the Greek word *electron*, meaning *amber*, because it was from the friction of a piece of amber that its existence was first discovered. The science of Electricity is comparatively new, and has no regular name assigned to it, although, being a great power in nature, it is frequently, like the several departments of mechanics, divided into electro-statics and electro-dynamics.

The last great power in the natural world, with which we shall close our review of the physical sciences, is that of Magnetism. No doubt, you have often observed that extraordinary power of attraction by which a common horseshoe magnet will draw towards it any small article of iron brought within the sphere of its influence. You have also heard of, or seen, the Mariners' Compass, with its little needle steadily pointing to the North Pole. Many fabulous stories have been told concerning this power. One well known to juvenile readers, is that of the mountain of loadstone, situated on an island in the midst of the sea, which attracted to itself all the nails and iron work about ships sailing near it, and thus caused them to fall to pieces, and their crews to perish. You may not indeed hear of anything so incredible as this, but you will meet with innumerable interesting facts and items of information by studying the science of magnetism.

Such are the four remaining physical sciences, completing, as it were, the survey of the natural world. Within the circle of the natural, the mathematical, and the sciences just described, is comprehended all that man has hitherto discovered and recorded concerning the universe, viewed as a mere collection of substances and forces. In future lessons we shall take into consideration another element, namely, the spiritual nature of man, introducing us into a world as wonderful, and no less interesting, than that which the physical sciences unfold before us.

The Physical Sciences—

Geology	Chemistry	Acoustics
Botany	Mechanics	Physiology
Zoology	Astronomy	Science of Heat
Meteorology	Optics	Science of Electricity
	Science of Magnetism.	

HEAT—CONDUCTION AND RADIATION.

SECT. 1. If you hold a stone in your hand above the earth's surface, you feel the weight of the stone, and you know that this feeling is produced by the attraction of the earth for the stone. When you let the stone loose, it falls, and thus the mutual attraction of the earth and stone is satisfied. If you were to examine the stone properly after its fall, you would find that it had become a little *warmed* by its concussion against the earth. Now, not only is heat developed when two large masses of matter come thus into collision, but we may descend to the smallest particles of matter—to what chemists call *atoms*—and find the same to be the case. Iron, for instance, has an attraction for oxygen: they unite together and form iron rust; but no particle of rust is formed, no single attraction between an atom of iron and an atom of oxygen is satisfied, without the development of heat. The tallow of a candle, and the gas we burn in our streets, are composed of carbon and hydrogen, both of which have a strong attraction for oxygen. The carbon unites with this oxygen, and forms carbonic acid gas; the hydrogen unites with the same substance, and forms water; here the satisfaction of each attraction develops heat, which finally attains the intensity which we observe in flame. A process exactly similar goes on in our own bodies. We eat butter and fat, which are composed chiefly of carbon and hydrogen, and we inhale oxygen from the air, which unites in our bodies with these two elements, and thus furnishes heat to the body. It is to all intents and purposes a slow combustion which goes on within us. The formation of iron rust is also a case of slow combustion; and if the combustion be rendered sufficiently intense, by igniting the metal in pure oxygen, a bar of iron may be burnt up as effectually as a bar of wood.

It is to the combustion going on within us, and not to the clothes we wear, that the warmth of our bodies is due. What useful purposes, then, do our clothes serve? They are made of materials which resist the passage of the heat from our bodies to the air, and thus prevent the incessant loss of heat. They have no power to confer heat, but they have the power to check its expenditure. Different kinds of clothes possess very different powers in this respect, some allowing the heat to travel through them more readily than others; and this leads me to consider for a few moments what is called the *conduction* of heat.

If you thrust one end of a cold poker into a fire, that end becomes warmed, and the heat is propagated from particle to particle through the poker, until, if the poker be not too long, the end most distant from the fire becomes also sensibly warmed. This mode of propagation is called *conduction*, and the power of conduction is possessed in very different degrees by different bodies. The metals are the best conductors, but they differ very much among themselves. The following is the order in which they stand, commencing with the best conductor, which is silver:—Silver, copper, gold, brass, tin, iron, steel, lead, platinum, bismuth.

Stones and crystals also differ from each other in their power of conducting heat; rock-crystal, for example, conducts heat much better than selenite. Some bodies possess different powers of conduction in different directions; most crystals possess this power. Wood conducts heat best along the fibre; next best across the rings that mark the growth of the tree; and worst, in the direction of these rings. Wool is an exceedingly bad conductor, and hence its value as a material for clothing; and hence, also, the reason why, if you place your hand upon a piece of cloth and a piece of metal on a cold day, the metal will *feel* much colder than the cloth, though both of them may really be of the same temperature. Cold consists in the abstraction of heat from the body; and the metal being a good conductor, does this far more speedily than the cloth, and hence feels colder.

Sect. 2. A heated body has also the power of sending out *rays* of heat, as a luminous body darts out rays of light. In the case of conduction, we regarded the propagation of heat from particle to particle within the mass of a body; in the present case, we have to deal with the heat shot out into space from the *surface* of the body. Some substances possess the power of radiation in a far greater degree than others; the metals, though they are the *best* conductors, are the *worst* radiators. This is particularly the case when they are polished. If a polished silver vessel, and a glass vessel of the same size, be filled with hot water and placed in calm air, it will be found that the water in the glass vessel cools much more quickly than that in the silver vessel; and the reason is, that the radiation from the glass is far more copious than from the silver. Nay, you can go further, and, by coating your silver vessel with flannel, you may actually hasten its cooling, flannel is so much better a radiator than silver.

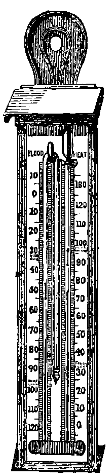
Now, pay attention to what I am about to say to you. All bodies radiate heat; even *ice* radiates heat. When the quantity of heat received by a body is greater than what it gives out, it becomes warmed; when less, it becomes cooled. If you stand before a stove, the stove gives heat to you, and you give heat to the stove; but the quantity you receive being greater than what you give, you are warmed. In like manner, when you stand before a block of ice, you receive heat from the ice, and you give heat to the ice in return; but the quantity you give is much greater than that which you receive, and hence you are chilled. In this way the heat of bodies is distributed by a process of *exchanges*.

This process is productive of very wonderful effects in nature; but before I refer to these, let me make my way clear. The air around us always contains a quantity of water in the form of vapour. You cannot see this vapour, but it nevertheless exists. If you take a perfectly dry glass, and pour into it a quantity of ice-cold water, you will find the outside of the glass become dim; this dimness being caused by the condensation to water, upon the surface of the cold glass, of the vapour which was previously invisible in the air. The sudden opening of a ball-room window in a northern climate has been known to cause *snow* to fall in the room, through the condensation and freezing of the vapour which, in the hot air of the room, was invisible. Thus you see when the air is sufficiently cooled, it deposits the vapour it contains, first in the form of water, and, if the cold be sufficient, even in the form of ice.

—PROFESSOR TYNDALL.

HEAT—EXPANSION; THE THERMOMETER.

The most remarkable and general effect of heat is to cause *expansion*, or enlargement. A piece of iron or brass, made hot, will be found to be larger in all its dimensions than when cold ; it will be longer, broader, and thicker, although without any alteration of weight. If it be artificially cooled by ice, on the other hand, it will become smaller in all its dimensions than before. A pint of cold water or spirit of wine, made hot, measures while hot more than a pint, and when cooled by ice, less than a pint. A bladder two-thirds filled with air, and the neck securely tied, becomes completely full when held for some time before a fire, so that the air may be well warmed ; and shrinks again to its former bulk on cooling. Many other examples might be given of the effects of heat in causing expansion in solids, liquids, and gases ; it is an effect which is general.



The thermometer is constructed on this principle:—A very narrow glass tube is taken, with a bulb or ball blown at one end, and enough quicksilver introduced to fill the bulb and part of the stem, after which the open end of the latter is closed, by melting the glass together. When this instrument is heated, in obedience to the general rule or law, the quicksilver, expanding or enlarging in bulk, rises in the stem, and, when cool, sinks, from contraction or shrinking of the liquid metal, so that the instrument becomes to a certain extent a measure of heat; and by making marks on the stem, or by fastening it to a scale of wood or ivory, upon which marks can be made, its usefulness for this purpose is increased. Such marks or divisions are called *degrees of heat* or *degrees of temperature*, the heat or cold, or *temperature*, of a liquid into which the thermometer is plunged, or of the air which surrounds it, being then measured or judged of by the mark or degree opposite to which the top of the column of quicksilver in the tube stands.

It is, of course, necessary in practice to adopt some plan for so dividing thermometer-scales as to render them alike, and make the degrees of one agree exactly with those of all the rest, and this is done by the help of two *fixed points of temperature*, namely, the temperature of melting ice, and the temperature of boiling water. The former never varies, and the latter only to a small extent, and under conditions which are well understood. The thermometer being plunged first into the one and then into the other, and the height of the quicksilver in each case carefully marked, the space between can be divided by a pair of compasses into degrees, which may be extended in like manner below the temperature of melting ice, and above that of boiling water. This temperature of melting ice is often called the freezing-point, water beginning to freeze, and ice to melt at the same temperature.

Thus it will be seen that in the division or *graduation* of a thermometer scale, the only fixed and invariable points are the freezing and the boiling-points of water, which are always the same on all thermometers; the space between may be divided into as many degrees as the maker pleases, and the degrees made large and few, or small and many. In English thermometers this space or interval is divided into 180 degrees; in French thermometers into 100 degrees. On the latter scale the degrees begin with 0 at the freezing-point, and run up to 100 degrees at the boiling-point; on the English scale, called the *Fahrenheit* scale after the name of the inventor, besides the degrees being smaller, the 0 or *zero* is placed 32 degrees below the freezing-point of water, so that the boiling-point of water on this scale is 212 degrees instead of 180. It is necessary to understand that to express the word *degree*, a sign or symbol is always made use of, which is a little °, or circle, placed on the right of the number, as in the following examples:—

Temperatures according to the English Thermometer.

Commencement of scale, .	0°
Freezing-point of water, . .	32°
Temperature of the blood, . .	98°
Boiling-point of water, . . .	212°
&c., &c., &c.	

Below 0° the numbers run in the opposite direction, being distinguished from the ordinary degrees by the negative sign (–). Thus, the temperature at which quicksilver freezes is expressed by –40° F., or, 40 degrees below the zero of Fahrenheit's scale. Spirits of wine is sometimes used for filling thermometers, and even air, for particular purposes, but those containing quicksilver are most generally useful. —FOWNES.

THE BEACON FIRE.

. . . . . The evening fell,
'Twas near the time of curfew bell;
The air was mild, the wind was calm,
The stream was smooth, the dew was balm;
E'en the rude watchman on the tower
Enjoyed and blessed the lovely hour.
Far more fair Margaret loved and blessed
The hour of silence and of rest.
On the high turret sitting lone,
She waked at times the lute's soft tone;
Touched a wild note, and all between
Thought of the bower of hawthorns green.
Her golden hair streamed free from band,
Her fair cheek rested on her hand,
Her blue eyes sought the west afar,
For lovers love the western star.

Is yon the star, o'er Penchryst Pen,
That rises slowly to her ken,
And, spreading broad its wavering light,
Shakes its loose tresses on the night?
Is yon red glare the western star?
Oh! 'tis the beacon-blaze of war!
Scarce could she draw her tightened breath,
For well she knew the fire of death!

The warder viewed it blazing strong,
And blew his war-note loud and long,
Till at the high and haughty sound,
Rock, wood, and river, rung around.
The blast alarmed the festal hall,
And startled forth the warriors all;
Far downward in the castle-yard,
Full many a torch and cresset glared;
And helms and plumes confusedly tost,
Were in the blaze half seen, half lost;
And spears in wild disorder shook,
Like reeds beside a frozen brook.

. . . . . .

Sweet Teviot! on thy silver tide
  The glaring bale-fires blaze no more;
No longer steel-clad warriors ride
  Along thy wild and willowed shore.
Where'er thou wind'st by dale or hill,
  All, all is peaceful, all is still,
As if thy waves, since Time was born,
  Since first they rolled upon the Tweed,
Had only heard the shepherd's reed,
  Nor startled at the bugle-horn.

Unlike the tide of human time,
  Which, though it change in ceaseless flow,
Retains each grief, retains each crime,
  Its earliest course was doomed to know;
And, darker as it downward bears,
Is stained with past and present tears.

—SCOTT.

MARVELS OF HUMAN CALORIC.

WE must be plain with our readers. It will not do to mince matters where questions of science are concerned. Dainty people will, no doubt, object to the proposition we are about to advance. Nevertheless, we persist. Fearless of the consequences, utterly unawed by the hisses which we know will ensue, we proceed to lay down the following assertion:—We are all living stoves—walking fire-places—furnaces in the flesh.

Now we do not intend to say that any one can light a cigar, or boil an egg, or even ignite a lucifer-match at these human hearths. Still, we repeat, these bodies of ours are stoves—fire-places—furnaces, if these terms can be applied to any apparatus for the express production of caloric. And is not heat produced in the human body by the union of oxygen with carbon, just the same as by the burning of wood in an open fire-place? and does not this union take place in the capillaries of the blood-vessels?

But, granting that our bodies are veritable stoves, the reader will desire to know where we procure our fuel. Fortunately our coal and firewood are stored up in a very interesting form. They are laid before us in the shape of bread and butter, puddings and pies; rashers of bacon for the labourer, and haunches of venison or turtle-soup for the epicure. Instead of being brought up in scuttles, they are presented in tureens, dishes, or tumblers, or all of them, in pleasant succession.

In fact, whenever you send a person an invitation to dinner, you virtually request the honour of his company to take fuel; and when you see him enthusiastically employed on your dainties, you know that he is literally "shovelling" fuel into his corporeal stove. The ultimate form in which this fuel is burned in the capillaries is that of carbon, with a little hydrogen and sulphur; but we swallow it in the shape of fat, starch, sugar, alcohol, and other less inflammatory compounds. By far the most heating of these substances is fat; ten pounds of this material, imported into your stove, will do as much work—that is, will produce as much warmth as twenty-five pounds of starch, twenty-five of sugar, or even twenty-six of spirits.

And a pleasant thing it is to observe how sagaciously the instinct of man has fastened upon the articles which will best supply him with the species of fuel he requires. The Esquimaux is extremely partial to oily fare. He does not know why. He never heard of the doctrine of animal heat. But he feels intuitively that bear's grease and blubber are the things for him. Condemn him to live on potatoes or Indian corn, and the poor fellow would resent the cruelty as much as an alderman of the old school if sentenced to subsist on water-gruel alone.

And the savage would be perfectly right. Exposed as he is to the fierce cold of a northern sky, every object around him plundering him of his caloric incessantly, what he needs is plenty of oily food, because from this he can produce the greatest quantity of heat. On the other hand, the native of the tropics, equally ignorant of animal chemistry, eschews the fiery diet, which his climate renders inappropriate, and keeps himself cool on rice, or dates, or watery fruits.

Hence we see the reason why a very stout man, if deprived of food, can keep up his corporeal fires for a longer time than a slender one. Human fat is fuel laid away for use. It constitutes a hoard of combustible material upon which the owner may draw whenever his ordinary supplies are intercepted. Let all plump persons therefore rejoice. We offer them our hearty, perhaps somewhat envious congratulations. They, at anyrate, are prepared to stand a long siege from cold.

For the same reason, animals which hybernate, like the bear, jerboa, marmot, dormouse, bat, and others, generally grow plump before they retire into winter quarters. Upon their capital of fat they subsist during their lethargy, their respiration being lessened, the pulse reduced to a few beats per minute, and the temperature perhaps nearly to the freezing point. But, when the season of torpor terminates, they issue from their caves and burrows meagre and ravenous, having burned up their stock of fuel, Bruin himself appearing to be anxious to defraud the perfumers of the unguent which is so precious in their eyes.

But perhaps the most striking feature in this warmth-producing apparatus within us, is the self-regulating power which it possesses. The fires on our domestic hearths decline at one moment and augment at another. Sometimes the mistress of the house threatens to faint on account of excessive heat; sometimes the master endeavours to improve the temperature by a passionate use of the poker, with an occasional growl respecting the excessive cold.

Were such irregularities to prevail unchecked in our fleshy stoves, we should suffer considerable annoyance. After a meal of very inflammatory materials, or an hour spent in extraordinary exertion, the gush of caloric might throw the system into a state of high fever. How is this prevented? In some of our artificial stoves, little doors or slides are employed to control the admission of air; in furnaces connected with steam-engines, we may have dampers which will accomplish the same purpose by the ingenious workings of the machine itself.

But neither doors nor dampers, pokers nor stokers, can be employed in the bodily apparatus. If, on the one hand, our human fires should begin to flag from undue expenditure of heat, the appetite speaks out sharply, and compels the owner to look round for fuel. Hunger rings the bell, and orders up coals in the shape of savoury meats. Or, should the summons be neglected, the garnered fat, as we have seen, is thrown into the grate to keep the furnace in play.

If, on the other hand, the heat of the body should become unreasonably intense, a very cunning process of reduction is adopted. When a substance grows too hot, the simplest method of bringing it into a cooler frame is to sprinkle it with water. This is precisely what occurs in our human frames. For no sooner does our internal heat rise above its standard height, than the perspiration tubes, with their six or seven millions of openings, indignant at the event, begin to pour out their fluid, so as to bathe the surface of the whole body. Whenever, therefore, a man becomes overheated by working, running, rowing, fighting, making furious speeches, or other violent exertions, he invariably resorts to this method of quenching the heat "by pouring on water."

What shall we say then, good reader? Speaking seriously, and looking at the question from a mere human point of view, could any project appear more hopeless than one for burning fuel in a soft, delicate fabric like the human body—a fabric composed for the most part of mere fluids—a fabric which might be easily scorched by excess of heat, or damaged by excess of cold? Does it not seem strange that a stove should have flesh for its walls, veins for its flues, and skin for its covering? Yet here is an apparatus which, as if by magic, produces a steady stream of heat—not trickling penuriously from its fountains, but flowing on day and night, winter and summer, without a moment's cessation, from January to December.

Carry this splendid machine to the coldest regions of the globe, set it up where the frosts are so crushing that nature seems to be trampled dead, still it pours out its mysterious supplies with unabated profusion. It is an apparatus, too, which does its work unwatched, and, in a great measure, unaided. The very fuel, which is thrown into it in random heaps, is internally sifted and sorted so that the true combustible elements are conveyed to their place, and applied to their duty, with unerring precision.

No hand is needed to trim its fires, to temper its glow, to remove its ashes. Smoke there is none, spark there is none, flame there is none. All is so delicately managed that the fairest skin is neither shrivelled nor blackened by the burning within. Is this apparatus placed in circumstances which rob it too fast of its caloric? Then the appetite becomes clamorous for food, and, in satisfying its demands, the fleshy stove is silently replenished. Or, are we placed in peril from superabundant warmth? Then the tiny flood-gates of perspiration are flung open, and the surface is laid under water until the fires within are reduced to their wonted level.

Assailed on the one hand by heat, the body resists the attack, if resistance be possible, until the store of moisture is dissipated; assailed on the other by cold, it keeps the enemy at bay until the hoarded stock of fuel is expended. Thus protected, thus provisioned, let us ask whether these human hearths are not entitled to rank among the standing marvels of creation? for is it not startling to find that, let the climate be mild or vigorous, let the wind blow from the sultry desert or come loaded with polar sleet, let the fluctuations of temperature be as violent as they may without us, there shall still be a calm, unchanging, undying summer within us?

—Dr George Wilson.

MOUNT VESUVIUS.

THE VOLCANO AND THE EARTHQUAKE.

VOLCANIC rocks are formed mostly from melted rock or lava which has issued from the interior of the earth; sometimes from showers of ashes which have issued from the craters of volcanoes, and spread over the adjoining country.

Everywhere the earth is warmer, the deeper the place examined —about 1° Fahrenheit for every fifty-four feet. From this, the existence of volcanoes at so many parts of the earth's surface, of hot springs at others, from the water of artesian wells being everywhere warmer the greater the depth from which it comes, and other considerations, it has been thought not improbable, that at a great depth the matter of the earth is so hot as to be in the fluid state, like molten lava. It has even been conjectured, that at one time the whole of the earth was one intensely hot fluid mass, and that the solid land has been formed by the more rapid cooling of the parts at the surface.

Volcanoes in a state of eruption present several remarkable phenomena. Flame, smoke, and large hot masses are projected from the crater, often to a considerable height. Mr Darwin describes, as follows, an eruption of the volcano of Osorno in South America: —"At midnight, the sentry observed something like a large star, which gradually increased in size till about three o'clock, when it presented a very magnificent spectacle. By the aid of a glass, dark objects, in constant succession, were seen, in the midst of a great glare of red light, to be thrown up and to fall down. The light was sufficient to cast on the water a long bright reflection. Large masses of molten matter seem very commonly to be cast out of the crater in this part of the Cordillera. I was assured that when the Corcovado is in eruption, great masses are projected upwards, and are seen to burst in the air, assuming many fantastical forms, such as trees; their size must be immense, for they can be distinguished from the high land behind S. Carlos, which is no less than ninety-three miles from the Corcovado."

Showers of ashes are also projected from volcanoes, which rise to a great height and spread very far. These are sometimes so dense as to darken the towns and villages, so that the inhabitants must carry lanterns with them in the streets in the middle of the day. This has happened during the eruptions of Vesuvius, and in Quito during the eruptions of Pichincha. "Lava streams," says Humboldt, "are less dreaded than an eruption of ashes, a phenomenon which fills the imaginations of men with images of terror, from the vague tradition of the manner in which Herculaneum, Pompeii, and Stabiæ were destroyed." The streets of Pompeii were filled up by the enormous quantities of ashes which fell upon them during eruptions of Vesuvius.

Another striking feature of an eruption is the *lava-stream*, which often issues from the sides of the volcanic mountain, and creeps with slow but steady steps over the adjoining country, which it covers with a bed of molten rock; destroying buildings, consuming the plants and trees it meets in its resistless progress, and thus covering the previous land with new land, and entirely altering the face of the country. An eruption of Vesuvius, in the early part ot the year 1850, was accompanied by a stream of lava, which overwhelmed several farm houses, a church, and priest's house, consumed orchards and forests; and the remarkable progress of which was witnessed by hundreds who came from the neighbouring towns to see the phenomenon. The lava shone at night with a red, lurid glare, with bright flames where it met and consumed the trees, some of which leaped in the air with an explosion, caused by the sudden separation of the moisture by the heat of the burning mass which destroyed them.

The sites of existing volcanic action are numerous. In EUROPE, Etna in Sicily; Vesuvius in Naples, the Lipari Islands, and Stromboli; and Hecla in Iceland. In ASIA, Kamtschatka, the Kurile and Japan Isles, the Philippine Islands, Java, and Sumatra, and Central Asia, S.W. of the Altai mountains. In NORTH AMERICA, the Aleutian Isles, and mountains of Mexico, Guatemala, and several of the West India Islands. In SOUTH AMERICA, the districts of Quito, of Peru and Bolivia, and of Chili. The Sandwich Islands; the Friendly Islands; Mount Egmont in the northern Island of New Zealand; and Mount Erebus, in South Victoria, in the antarctic regions. The Azores, Canary Islands, and Cape Verde Islands, are also volcanic districts.

The EARTHQUAKE, the name of which expresses its own meaning distinctly, is a phenomenon allied to the volcano, and produced most probably by the same cause which, in varied circumstances and different situations, give rise to volcanic eruption. The districts of the earth's surface visited by earthquakes, within a recent period, are very extensive. They have been experienced in the Old World, from Iceland to Ceylon, from the Azores to Lake Baikal, from Abyssinia to the north of Norway, and from Kamtschatka to the north-west of Australia; in North America, between the great lakes and the Gulf of Mexico, and in Mexico; in Central America and the West Indies; and in South America, in Venezuela and Ecuador, and along the west coast to the south of Chili. There have been between two and three hundred slight earthquake shocks experienced in Britain. The motion of the land in the earthquake is, most usually, *undulatory*, like that of a wave. Sometimes there is a violent *vertical* motion from below upwards, which was strikingly exhibited in the great earthquake which overthrew Riobamba in 1797, when the bodies of many of the inhabitants were hurled to Cullca, a hill several hundred feet in height, and on the opposite side of the river Lican. In the same earthquake, the *circular* or *gyratory* concussions were exhibited, when the furniture of one house was found under the ruins of another; and this latter kind of motion, as well as the undulatory motion, occurred in the great earthquake at Lisbon in 1755.

Humboldt concludes that "the forces causing earthquakes are not seated near the surface in the thin crust of the earth, but deep in the interior of our planet, whence through fissures and unfilled veins they act simultaneously at widely distant points of the earth's surface."—*Views of Nature.*

Allied to the earthquake, but of a more regular and peaceful character, is that slow movement going on in many parts of the world, by which the land gradually rises above, or sinks below, the level of the sea. This is going on at the north shore of the Baltic Sea, which seems to be rising at the rate of several feet in a century above the level of the sea. The island of Reguain, on the west coast of Aracan, has been in process of gradual upheaval for some time; while the lagoons and barrier-reefs of the Pacific are explained by Mr Darwin on the supposition of a *subsiding* of the land; and a similar action is believed to be going on in parts of the southern shores of the Baltic. —REID.

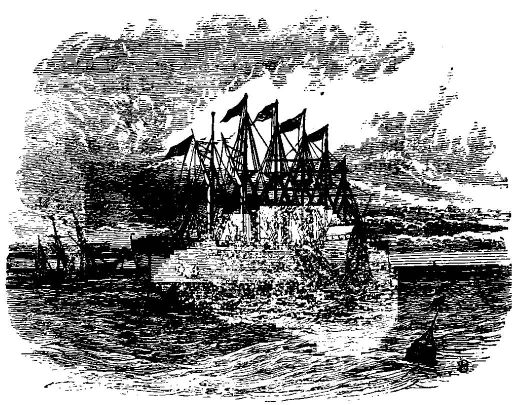
ELECTRICITY.

WHAT electricity or the electric fluid is, no man knows. The earliest notion of it was obtained through amber, called by the Greeks electron, and by the Romans electrum. This substance was observed by the ancients to possess so curious a capacity that, by being rubbed, it became able to draw to itself, and to hold for a short time while in suspension, any loose light substances, such as small pieces of feather, which happened to be in its vicinity. Many other substances, such as resins, gums, glass, sulphur, and silk, were in the course of time observed to possess the same capacity; and, in allusion to amber, were designated electrics. Their peculiar power—the power put into them by friction—was very long regarded as a mystery, an amusement, or a thing merely to be wondered at; but eventually, it was accumulated in large quantity, and found to emit crackling sounds and sparkling light, and to give off smart, instantaneous, energetic shocks; and then it was assumed to be a distinct, though obscure element, and called electricity.

The first thought of any consequence which occurred in connexion with it, was to use it for the cure of diseases. A particular kind of friction machine was constructed for obtaining quantities of it at will, and for pouring them upon invalids at a touch; and this acquired rapid, general, over-towering fame, as one of the grandest inventions ever known in the healing art,—but was so abused by quacks, and so enormously over-estimated by physicians, that it soon became little more than a means of philosophic experiment. In this character, however, it led the way to amazing discoveries. The power obtained by it was easily proved to be got out of the ground; for when the machine stood on any substance which could not become electrically affected by friction, it was useless; and when standing on the ground, it always retained all its susceptibility. Either the crust of the earth, or perhaps the solid globe, was hence inferred to be one vast reservoir of electricity. A suspicion by and by arose that the air is full of it too, or, at least, that the lightning of thunderstorms, and the crackling, sparkling, energetic power of the electric machine, were the same thing; and this suspicion was traced on to truth, in a series of masterly experiments, by several distinguished philosophers of Europe; and, most of all, by the distinguished Franklin of America. Electricity henceforth was recognised as a grand agent in weather,—and particularly as the presiding power in thunderstorms, sultriness, outbursts of typhoon, and hurricane; and, in the course of later, manifold, and highly curious investigations, it came to be identified also—at least as to its essential characteristics, though under great differences of intensity and of some other characters, with several sorts of luminous appearances in the air, with the formation of hail-showers, with the occasional luminosity of fogs and snow, with the peculiar power of magnets, with the peculiar power of the galvanic pile of the voltaic battery, with certain energies of steam and gun-cotton, and other remarkable things or conditions of things, and with the subtle agencies over animal physiology and animal life which have obtained the designations of mesmerism, electro-biology, animal magnetism, and odyle.

Still no man can tell what electricity is. It may be a material fluid of the closest possible similarity, which a material thing can possess to an immaterial,—and therefore prodigiously versatile, prodigiously subtle, and without any appreciable weight; or it may be two such fluids most curiously related to each other, yet mutually repulsive, and rushing off to opposite poles. It may be a substance or substances strictly peculiar; or it may be a primal element identical in some way with the matter of light and heat, and possibly also with the matter of some of those seemingly indecomposable things which chemists call elements. Or it may be not a fluid or substance, or primal element at all, but only a condition of something else so subtle and recondite as hitherto to have escaped all detection or recognition by man. Yet here is a wonder that, nevertheless, it displays itself to all eyes, and works magnificently and mightily as one of the sublimest powers of nature, and behaves according to laws of the most perfect precision, and not difficult to be ascertained, and is altogether as well known by its properties and effects as many of the grossest substances which lie thoroughly open to man's investigation. And another wonder is that, in spite of all diversities of character, it is essentially and absolutely the same in the crashing thunderbolt, the beauteous aurora, and the tiny machine-spark,—the same in the tornado, the magnet, and the dew-drop,—the same in shivering the lightning-rod, in playing on the mariner's compass, and in gliding along the telegraphic wire,—the same in creating a hail-storm, in producing an electrotype, in mesmerising a man, and in convulsing a corpse.

—Rev. J. M. Wilson.



PAYING OUT CABLE.

THE ATLANTIC OCEAN AND THE TELEGRAPH.

The Atlantic Ocean stretches from the Arctic Circle on the north to the Antarctic Circle on the south, a distance of 9000 miles. Its breadth varies from 1200 miles between the coasts of Greenland and Norway, to 3500 miles from the peninsula of Florida to Cape Verde. on the western coast of Africa. Humboldt compares the bed of the Atlantic to a long, deep valley, which may be said to extend from pole to pole. The North Atlantic varies in depth from 6000 to 25,000 feet. The deepest part, says Lieutenant Maury, is probably between the Bermudas and the Grand Banks of Newfoundland; but how deep it may be, yet remains for the sounding line to determine. One result of recent measurements of the depth of the Atlantic by the British and American navies is, the certain knowledge we now possess that the bed of the ocean, like the land, is diversified by mountains and valleys, hills, table-lands, and plains.

Between Newfoundland and Ireland the bed of the Atlantic is so remarkably level, that it has received the name of the Telegraphic Plateau. In making soundings for the telegraphic cable across this plateau, various specimens of the bottom were brought up, by means of an apparatus attached to the sounding-line. These were submitted to the celebrated microscopist, Professor Ehrenberg, and were found to consist of minute shells, perfect in form, some of them quite fresh, and having the remains of the animal in them, showing that in this part of the Atlantic there are no currents to disturb the bottom of the sea. It is an established fact, indeed, that there is no running water at the bottom of the *deep* sea. The agents which disturb the equilibrium of the ocean, giving violence to its waves and force to its currents, all reside near or above its surface; none of them have their home in its depths.

Wherever specimens of the bottom have been obtained by the deep-sea plummet, they have been found to consist of minute microscopic shells. If the bottom were disturbed by currents, these minute shells would be found scratched, and their sharp corners and edges broken off and rounded. Moreover, were they drifted about, sand and other scourings of the ocean would be mixed with them. But not so; the specimens brought up from the deep show no such mixture, and bear no marks of abrasion upon even their most delicate parts.

In these still and quiet waters at the bottom of the Atlantic it was decided to lay the telegraphic cable—the distance from land to land being about 1600 miles.

In the summer of 1857 the *Agamemnon* of the British navy and the *Niagara* of the American navy were assigned by their respective governments to the duty of receiving on board and laying the submarine Atlantic cable. After several unsuccessful attempts in 1857 and 1858, the vessels met in mid-ocean, joined cables, and set out, the *Niagara* for her terminus in Trinity Bay, Newfoundland, and the *Agamemnon* for hers in Valencia Harbour. On the 5th of August the cable was successfully landed on both shores; and a week afterwards, messages of congratulation were flashed across the ocean between the Queen of England and the President of the United States.

Though short-lived, it was a grand achievement. It demonstrated the possibility of uniting by telegraph the New World with the Old —an achievement destined yet to be one of the great events of the nineteenth century.*

Referring to this subject, a distinguished author thus writes:—

"Let me offer you two feebly outlined word-pictures of events which were transacted on the same arena, at the interval of nearly four centuries. The epoch of the first is the autumn of 1492. The scene is the mid-Atlantic, and on its bosom floats the frail caravel of Columbus. It is midnight, and the astonished pilots are gazing with awe on the compass-needle, which has ceased to point to the North-star, and has veered round to the west; and they ask the great admiral what this unheard-of variation may mean. To him it is a mystery as well as to them, but he has an explanation which contents them; and for himself, however mysterious it may be, it is anew the finger of God bidding him sail westward still; and he follows its new pointing, till it lands him on the shore he has so often seen in his dreams.

"The time of the second picture is 1858. The scene, as before, is the mid-Atlantic, and on its bosom a great English steam-ship is silently gliding with every sail furled. It is midnight again, and the sailors, as in the caravel four centuries ago, are gazing with intense eyes upon a quivering needle. It is not now, however, a mere compass-needle; but, armed with a tiny mirror, it lies in the centre of a coil of wire looped to the great cable, which, as electric signals pass along it, is every moment bringing the Old and the New Worlds nearer each other in time. Every quiver to east and west that the needle makes, as the voltaic current sweeps round the coil, flashes from the mirror a spot of light on a screen, and marks a step in progress; and all watch the face of the electrician, the Columbus of this voyage, to whom alone these spots of light are intelligible and eloquent of success. And so the mirrored, flashing galvanometer sways about, till the voyage ends; and then *Gloria in excelsis* is literally quivered in light, as it was by its first singers the angels, and in unconscious repetition of its chant by the kneeling crews of Columbus four centuries ago.

"Let us wish all success to the telegraph everywhere. The best interests of the world are bound up in its progress, and its mission

* And now (1866) successfully accomplished.

is emphatically one of peace. It does not merely speak swiftly, but softly; and it offers men a common speech, in which all mankind can converse together.

"Men have spoken, men have dreamed,
Of a universal tongue;
Universal speech can be
Only when the words are sung,
When our harp has all its strings,
And its music fills the air,
In a universal tongue
All the world shall share."

—MAURY AND DR G. WILSON.

GRAPPLING THE CABLE BY MOONLIGHT.

STORY OF PROSPERO.

Enter ARIEL.

Ariel. All hail, great master! grave sir, hail! I come
To answer thy best pleasure; be 't to fly,
To swim, to dive into the fire, to ride
On the curl'd clouds; to thy strong bidding task
Ariel, and all his quality.

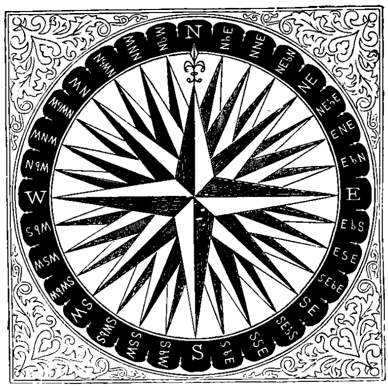
Prospero. Hast thou, spirit,
Perform'd to point the tempest that I bade thee?

Ari. To every article.
I boarded the king's ship; now on the beak,
Now in the waist, the deck—in every cabin,
I flamed amazement: Sometimes, I 'd divide,
And burn in many places; on the topmast,
The yards, and bowsprit, would I flame distinctly;
Then meet, and join. Jove's lightnings, the precursors
O' the dreadful thunder-claps, more momentary
And sight-outrunning were not: the fire, and cracks

Of sulphurous roaring, the most mighty Neptune
Seem'd to besiege, and make his bold waves tremble,
Yea, his dread trident shake.
Pro. My brave spirit!
Who was so firm, so constant, that this coil
Would not infect his reason?
Ari. Not a soul
But felt a fever of the mad, and play'd
Some tricks of desperation.
Pro. Why, that 's my spirit!
But was not this nigh shore?
Ari. Close by, my master.
Pro. But are they, Ariel, safe?
Ari. Not a hair perish'd:
On their sustaining garments not a blemish,
But fresher than before; and, as thou bad'st me,
In troops I have dispersed them 'bout the isle.
The king's son have I landed by himself;
Whom I left cooling of the air with sighs,
In an odd angle of the isle, and sitting
His arms in this sad knot.
Pro. Of the king's ship,
The mariners, say, how thou hast disposed,
And all the rest o' the fleet?
Ari. Safely in harbour
Is the king's ship; in the deep nook, where once
Thou call'dst me up at midnight, to fetch dew
From the still-vex'd Bermoothes—there she 's hid:
The mariners all under hatches stow'd;
Whom, with a charm join'd to their suffer'd labour,
I have left asleep. And for the rest o' the fleet,
Which I dispersed, they all have met again;
And are upon the Mediterranean wave,
Bound sadly home for Naples;
Supposing that they saw the king's ship wreck'd,
And his great person perish.
Pro. Ariel, thy charge
Exactly is perform'd; but there 's more work:
What is the time o' the day?
Ari. Past the mid season.
Pro. At least two glasses—the time 'twixt six and now
Must by us both be spent most preciously.

Ari. Is there more toil! Since thou dost give me pains,
Let me remember thee what thou hast promised,
Which is not yet perform'd me.
Pro. How now? moody?
What is't thou canst demand?
Ari. My liberty.
Pro. Before the time be out? No more.
Ari. I pray thee
Remember, I have done thee worthy service;
Told thee no lies, made no mistakings; served
Without or grudge or grumblings: thou didst promise
To bate me a full year.
Pro. Dost thou forget
From what a torment I did free thee!
Ari. No.
Pro. Thou dost: and think'st
It much to tread the ooze of the salt deep;
To run upon the sharp wind of the north;
To do me business in the veins o' the earth
When it is baked with frost.
Ari. I do not, sir.
Pro. If thou more murmur'st, I will rend an oak
And peg thee in his knotty entrails, till
Thou hast howl'd away twelve winters.
Ari. Pardon, master:
I will be correspondent to command,
And do my spiriting gently.
Pro. Do so; and after two days
I will discharge thee.
Ari. That's my noble master!
What shall I do! say, what—what shall I do?
Pro. Go make thyself like to a nymph o' the sea;
Be subject to no sight but mine—invisible
To every eyeball else. Go, take this shape,
And hither come in 't. Hence, with diligence!
(*Exit* Ariel.)

—SHAKESPEARE—*The Tempest.*



MARINER'S COMPASS.

MAGNETISM—THE LOADSTONE AND THE MAGNET.

The ancients were fully acquainted with the loadstone, and with its power of attracting iron, though they were totally ignorant of its polarity. That they were so, is evident from the fact that the classic authors and ancient works upon navigation and kindred subjects do not furnish one word upon the subject. Claudian has left, in one of his idyls, a long description of the stone, and of its peculiar, indeed magical affinity for iron. Had he entertained the most distant idea that this stone would communicate to a steel needle the power of indicating the north, it is not to be supposed for an instant that he would have omitted mentioning it. The earliest name of the loadstone was Hercules' Stone, which was soon changed to *magnes*, from the fact that it was found in abundance in a region called Magnesia, in Lydia. Hence our word magnet. It was not till the fourth century of our era that the quality of repelling as well as of attracting iron seems to have been discovered. Marcellus, the physician of Theodosius the Great, is the first author who mentions this new quality.

The Romans, who acquired a knowledge of the magnet from the

Greeks, preserved the name, though several of their authors, and Pliny among them, mention a tradition that the magnet was so called from a shepherd named Magnes, who was the first to discover a mine of loadstone, by the nails in his shoes clinging to the metal.

The first mention in European history of the polarity of the magnetised needle, and of its importance to mariners, occurs in a satirical French poem written in 1190 by one Guyot de Provins. It may be very properly inferred, from the fact that the poet does not merely allude to the compass, but describes it and the polar star at some length, that it was not generally known, and, in fact, had been lately introduced into the Mediterranean. Whence it had been introduced there, we shall learn as we proceed.

The second historical mention of the compass occurs in a description of Palestine by Cardinal Jacques de Vitry, in the year 1218, in which is the following passage:—"The loadstone is found in India, to which, from some hidden cause, iron spontaneously attaches itself. The moment an iron needle is touched by this stone, it at once points towards the north star, which, though the other stars revolve, is fixed as if it were the axis of the firmament: from whence it has become necessary to those who navigate the seas."

Brunetto Latini, a grammarian of Florence, and preceptor of Dante, settled in Paris about the year 1260, and composed a work entitled the "Treasure," in which he distinctly describes the process and the consequence of magnetising a needle. He also went to England, and in a letter, of which fragments have been published, writes thus:—"Friar Bacon showed me a magnet, an ugly and black stone, to which iron doth willingly cling: you rub a needle upon it, the which needle, being placed upon a point, remains suspended and turns against the star, even though the night be stormy and neither star nor moon be seen; and thus the mariner is guided on his way."

The Italian Jesuit Riccioli, in his work upon geography and hydrography, states, that before 1270, the French mariners used "a magnetised needle, which they kept floating in a small vessel of water, supported on two tubes, so as not to sink."

All these authors agree in fixing the period at which the use of the needle was popularised in Europe, at the latter part of the twelfth and the commencement of the thirteenth century. Not one of them mentions the inventor by name, or even indicates his nation. This circumstance leads to the conviction that it was unknown to them, and that, consequently, the inventor was not a European. The theory that the Europeans obtained it from the

Arabians, and the Arabians from the Chinese, is supported by the following facts :—

A manuscript work written by an Arabian named Bailak, a native of Kibdjak, and entitled, "The Merchants' Guide in the Purchase of Stones," thus speaks of the loadstone in the year 1242 :— "Among the properties of the magnet, it is to be noticed that the captains who sail in the Syrian waters, when the night is dark, take a vessel of water, upon which they place a needle buried in the pith of a reed, and which thus floats upon the water. Then they take a loadstone as big as the palm of the hand, or even smaller. They hold it near the surface of the water, giving it a rotary motion until the needle turns upon the water: they then withdraw the stone suddenly, when the needle, with its two ends, points to the north and south. I saw this with my own eyes, on my voyage from Tripoli, in Syria, to Alexandria, in the year 640. [640 of the Hegira, 1240 A.D.] I heard it said that the captains in the Indian seas substitute for the needle and reed a hollow iron fish, magnetised, so that, when placed in the water, it points to the north with its head and to the south with its tail. The reason that the fish swims, not sinks, is that metallic bodies, even the heaviest, float when hollow, and when they displace a quantity of water greater than their own weight."

It may be fairly inferred from this passage, that, at the time spoken of, (1240,) the practice was already of long standing in this quarter, and that the needle and its polarity had been long known and employed at sea. That is, the Arabs had become familiar with the loadstone in 1240, while Friar Bacon regarded it, in England, as a curiosity in 1260—twenty years afterwards. The priority of the invention would seem to be thus incontestibly proven for the Arabs. But we shall see speedily that it derived its origin from a region situated still farther to the east, and many centuries earlier.

A famous Chinese Dictionary, terminated in the year 121 of our era, thus defines the word magnet:—"The name of a stone which gives direction to a needle." This is quoted in numerous modern dictionaries. One published during the Tsin dynasty—that is, between 265 and 419, states that ships guided their course *to the south* by means of the magnet. The Chinese word for magnet—*tchi nan*, —signifies, indicator of the south. It was natural for the Chinese, when they first saw a needle point both north and south, to take the Antarctic Pole for the principal point of attraction, for with them the south had always been the first of the cardinal points— the emperor's throne and all the government edifices invariably being built to face the south. A Chinese work of authority, composed about the year 1000, contains this passage:—"Fortune-tellers rub the point of a needle with a loadstone to give it the power of indicating the south."

A medical natural history, published in China in 1112, speaks even of the variation of the needle,—a phenomenon first noticed in Europe by Christopher Columbus in 1492. "When," it says, "a point of iron is touched by a loadstone, it receives the power of indicating the south: still, it declines towards the east, and does not point exactly to the south." This observation, made at the beginning of the twelfth century, was confirmed by magnetic experiments made at Pekin, in 1780, by a Frenchman; only the latter, finding the variation to be from the north, set it down as from 2° to 2° 30′ to the west, while the Chinese, persisting in calling it a variation from the south, set it down as being from 2° to 2° 30′ to the east.

Thus, the Chinese, who were acquainted with the polarity of a magnetised needle as early as the year 121, and who noticed the variation in 1112, may be safely supposed to have employed it at sea in the long voyages which they made in the seventh and eighth centuries, the route of which has come down to us. Their vessels sailed from Canton, through the Straits of Malacca, to the Malabar coast, to the mouths of the Indus, and the Euphrates. It is difficult to believe that, aware of the use to which the needle might be applied, they did not so apply it.

While thus claiming for the Chinese the first knowledge and application of the polarity of the needle, we may say, incidentally, that it is now certain that they made numerous other discoveries of importance long before the Europeans. They knew the attractive power of amber in the first century of our era, and a Chinese author said, in 324, "The magnet attracts iron, and amber attracts mustard-seed." They ascribed the tides to the influence of the moon in the ninth century. Printing was invented in the province of China about the year 920, and gunpowder would seem to have been made there long before Berthold Schwartz mixed it in 1330. Still, it is not necessary to resort to the argument of analogy to support the claims of the Chinese to this admirable invention: the direct evidence is sufficient.

A century ago, Flavio Gioia, a captain or pilot of Amalfi, in the kingdom of Naples, was recognised throughout Europe as the true inventor of the compass. He lived in the beginning of the fourteenth century, and biographers have even fixed the date of the memorable invention at the year 1303. The principal foundation for this assertion was the following line from a poem by Antonio of Bologna, who lived but a short time after Gioia:—

"Prima dedit nautis usam magnetis Amalphis."
(Amalfi first gave to sailors the use of the magnet.)

The tradition was subsequently confirmed by the statement made by authors of repute, that the city of Amalfi, in order to commemorate an invention of so much importance, assumed a compass for its coat-of-arms. This was believed till the year 1810, when the coat-of-arms for Amalfi was found in the library at Naples. It did not answer at all to the description given of it; instead of the eight wings which were said to represent the four cardinal points and their divisions, it had but two, in which no resemblance to a compass could be traced. Later investigations have, as we have said, completely demolished all the arguments by which the compass was maintained to be of European origin and of modern date. The curious reader will find the extracts from Chinese works which substantiate the Chinese claim, in a volume published in 1834, at Paris, by M. J. Klaproth, and composed at the request of Baron Humboldt.

No mention whatever is extant of the first venture made upon the Atlantic under the auspices of this mysterious but unerring guide. Science and history must for ever regret that the first European navigator who employed it did not leave a record of the experiment. What would be more interesting to-day than the log of the earliest voyage thus accomplished in European waters? The modern reader would surely give his sympathy, unreservedly, to a narrative in which the navigator should describe his wonder, his terror, his joy, when, throughout the voyage, he saw the tremulous index point invariably north; when, upon the dispersion of the clouds which had concealed the star from view, it was found precisely where the needle indicated; when, upon its being diverted from the line of direction by some curious and perhaps incredulous experimenter, it slowly but surely returned, remaining fixed and constant through storms and calm, at midnight and at noon. What would be more interesting than the speculations of such a captain upon the cause of the marvellous dispensation? And what more amusing than the commentaries of the forecastle, and the learned explanation of the veteran salts to the raw recruits; but all this absorbing lore has hopelessly disappeared, and the mariner's compass will for ever remain mysterious in its principle, mysterious in its origin, mysterious in its history.

—GOODRICH'S *The Sea.*

PHYSIOLOGY—CIRCULATION OF THE BLOOD.

THE manner in which the blood-vessels are disposed in the human body bears some resemblance to the arrangement of the pipes by which a great city is supplied with water. London is supplied by means of an engine contrived for the purpose of distributing the water of the New River through the city. Large trunks are carried from this machine in different directions; smaller pipes branch out from these trunks into streets, lanes, and alleys; still smaller ones issue from them, and convey the water into private houses. So far the resemblance is complete. These water-pipes represent the *arteries* which carry the blood from the heart to the extremities of the body; but in the human body another contrivance was necessary. The citizens of London may use the water or waste it as they please; but the precious fluid conveyed by the arteries to the ends of the fingers must be returned to the heart; for on its unceasing circulation our health depends.

In order to effect this purpose, another set of pipes is prepared, called *veins*, which, joining the extremities of the arteries, receive the blood from them, and carry it back again to the heart. The veins present the same general appearance as the arteries; but as it is the office of the arteries to distribute the blood, so it is that of the veins to collect it. Through them it flows back to the heart in a manner just the reverse of that in which it sets out; the minute veins unite in larger branches, the larger branches unite in still larger trunks, till the collected blood is at length poured into the heart through one opening.

The engine that works this curious machinery is the *heart.* The heart is composed of four cavities. Like other muscles, it has the power of contracting; and when it contracts, the sides of its cavities are squeezed together, so as to force out any fluid the heart may at that moment contain. This purpose being effected, the fibres relax, the heart once more becomes hollow, and as it dilates, the blood pours into the cavities from the large veins which brings it back to the heart. The next contraction forces the blood into the arteries, the quantity thus impelled being always equal to that which has just been received; and thus this wonderful organ goes on, alternately contracting and dilating itself, *four thousand* times in an hour. Month after month, year after year, it goes on without weariness or interruption, conveying renewed strength to every part of the body. The two largest cavities of the heart, which send out the blood to the arteries, are called *ventricles;* the two smallest, which receive it from the veins, *auricles.* All the arteries are furnished with valves that play easily forward, but admit not the blood to return to the heart.

In all this there is abundant evidence of wise contrivance. The blood, in going out from the heart, is continually passing from wide tubes into those which are narrower; in coming back, it passes from narrow vessels into wider; consequently the blood presses the sides of the arteries with greater force than it acts against the coats of the veins. To prevent any danger from this difference of pressure, the arteries are formed of much tougher and stronger materials than the veins. This is one difference between the two; there is another still more strikingly illustrative of the care of the Great Artificer. As a wound in the arteries, through which the blood passes with such force from the heart, would be more dangerous than a wound in the veins, the arteries are defended, not only by their stronger texture, but by their more sheltered situation. They are deeply buried among the muscles, or they creep along grooves made for them in the bones. The under side of the ribs is sloped and furrowed, to allow these important tubes to pass along in safety; and in the fingers, which are liable to so many casualties, the bones are hollowed out in the inside like a scoop. Along this channel the artery runs in such security, that you might cut your finger across to the bone without doing it any injury.

—Mrs Hack.

THE COMPLAINT OF A STOMACH.

[The stomach, after having suffered much from the great and unnecessary amount of labour required of it, and from unseasonable meals, stimulating drinks, and want of rest, is supposed to make the following complaint.]

Being allowed for once to speak, I would take the opportunity to set forth how ill, in all respects, we stomachs are used. From the beginning to the end of life, we are either afflicted with too little or too much, or not the right thing, or things which are horribly disagreeable to us, or we are otherwise thrown into a state of discomfort. I do not think it proper to take up a moment in bewailing the Too Little, for that is an evil which is never the fault of our masters, but rather the result of their misfortunes; and, indeed, we would sometimes feel as if it were a relief from other kinds of distress, if we were put upon short allowance for a few days. But we conceive ourselves to have matter for serious complaint against mankind in respect of the Too Much, which is always an evil voluntarily incurred.

What a pity that, in the progress of discovery, we cannot establish some means of a good understanding between mankind and their stomachs; for really the effects of their non-acquaintance are most vexatious. Human beings seem to be, to this day, completely in the dark as to what they ought to take at any time, and err almost as often from ignorance as from depraved appetite. Sometimes, for instance, when we of the inner house are rather weakly, they will send us down an article that we could deal with only when in a state of robust health. Sometimes, when we would require a mild vegetable diet, they will persist in the most stimulating and irritating of viands.

What sputtering we poor stomachs have when mistakes of that kind occur! What remarks we indulge in regarding our masters! "What's this now?" will one of us say; "ah, detestable stuff! What a ridiculous fellow that man is! Will he never learn! Just the very thing I did not want. If he would only send down a bowl of fresh leek soup, or barley broth, there would be some sense in it!" and so on. If we had only been allowed to give the slightest hint now and then, like faithful servants as we are, from how many miseries might we have saved both our masters and ourselves!

I have been a stomach for about forty years, during all of which time I have endeavoured to do my duty faithfully and punctually. My master, however, is so reckless, that I would defy any stomach of ordinary ability and capacity to get along pleasantly with him. The fact is, like almost all other men, he, in his eating and drinking, considers his own pleasure only, and never once reflects on the poor wretch who has to be responsible for the disposal of everything down-stairs. Scarcely on any day does he fail to exceed the strict rule of temperance; nay, there is scarcely a single meal which is altogether what it ought to be. My life is therefore one of continual worry and fret; I am never allowed to rest from morning till night, and have not a moment in the four-and-twenty hours that I can safely call my own.

My greatest trial takes place in the evening, when my master has dined. If you only saw what a mess this said dinner is—soup, fish, flesh, fowl, ham, rice, potatoes, table-beer, sherry, tart, pudding, cheese, bread, all mixed up together. I am accustomed to the thing, so don't feel much shocked; but my master himself would faint at the sight. The slave of duty in all circumstances, I call in my friend Gastric Juice, and we set to work with as much good-will as if we had the most agreeable task in the world before us. But, unluckily, my master has an impression very firmly fixed upon him that our business is apt to be vastly promoted by an hour or two's drinking; so he continues at table among his friends, and pours down some bottle and a half of wine, perhaps of various sorts, that bothers Gastric Juice and me to a degree which no one can have any idea of.

In fact, this said wine undoes our work almost as fast as we do it, besides blinding and poisoning us poor servants into the bargain. On many occasions I am obliged to give up my task for the time altogether; for while this vinous shower is going on, I would defy the most vigorous stomach in the world to make any advance in its business worth speaking of. Sometimes things go to a much greater length than at others; and my master will paralyse us in this manner for hours, not always, indeed, with wine, but occasionally with punch, one ingredient of which—the lemon—is particularly odious to us. All this time I can hear him jollifying away at a great rate, drinking healths to his neighbours, and ruining his own.

I am a lover of early hours, as are my brethren generally. To this we are very much disposed by the extremely hard work which we usually undergo during the day. About ten o'clock, having, perhaps, at that time got all our labours past, and feeling fatigued and exhausted, we like to sink into repose, not to be again disturbed till next morning at breakfast-time. Well, how it may be with others I can't tell; but so it is, that my master never scruples to rouse me up from my first sleep, and give me charge of an entirely new meal, after I thought I was to be my own master for the night. This is a hardship of the most grievous kind.

Only imagine me, after having gathered in my coal, drawn on my night-cap, and gone to bed, called up and made to take charge of a quantity of stuff which I know I shall not be able to get off my hands all night! Such, O mankind, are the woes which befall our tribe in consequence of your occasionally yielding to the temptations of "a little supper." I see turkey and tongue in grief and terror. Maccaroni fills me with frantic alarm. I behold jelly and trifle follow in mute despair. Oh that I had the power of standing beside my master, and holding his unreflecting hand, as he thus prepares for my torment and his own!

Here, too, the old mistaken notion about the need of something stimulating besets him, and down comes a deluge of hot spirits and water, that causes me to writhe in agony, and almost sends

Gastric Juice off in the sulks to bed. Nor does the infatuated man rest here. If the company be agreeable, one glass follows another, while I am kept standing, as it were, with my sleeves tucked up, ready to begin, but unable to perform a single stroke of work.

I feel that the strength which I ought to have at my present time of life has passed from me. I am getting weak, and peevish, and evil-disposed. A comparatively small trouble sits long and sore upon me. Bile, from being my servant, is becoming my master; and a bad one he makes, as all good servants ever do. I see nothing before me but a premature old age of pains and groans, and gripes and grumblings, which will, of course, not last over long; and thus I shall be cut short in my career, when I should have been enjoying life's tranquil evening, without a single vexation of any kind to trouble me.

Were I of a revengeful temper, it might be a consolation to think that my master—the cause of all my woes—must suffer and sink with me; but I don't see how this can mend my own case; and, from old acquaintance, I am rather disposed to feel sorry for him, as one who has been more ignorant and imprudent than ill-meaning. In the same spirit let me hope that this true and unaffected account of my case may prove a warning to other persons how they use their stomachs; for, they may depend upon it, whatever injustice they do to *us*, in their days of health and pride, will be repaid to *themselves* in the long run—our friend, Madam Nature, being a remarkably accurate accountant, who makes no allowance for ignorance or mistakes. —CHAMBERS.

LINES ON A SKELETON.

I.

BEHOLD this ruin! 'Twas a skull,
Once of ethereal spirit full.
This narrow cell was Life's retreat,
This space was Thought's mysterious seat.
What beauteous visions filled this spot,
What dreams of pleasure long forgot.
Nor Hope, nor Love, nor Joy, nor Fear,
Have left one trace of record here.

II.

Beneath this mouldering canopy
Once shone the bright and busy eye;
But, start not at the dismal void—
If social love that eye employed;
If with no lawless fire it gleamed,
But through the beams of kindness beamed,
That eye shall be for ever bright
When stars and suns are sunk in night.

III.

Within this hollow cavern hung
The ready, swift, and tuneful tongue.
If Falsehood's honey it disdained,
And where it could not praise, was chained;
If bold in Virtue's cause it spoke,
Yet gentle Concord never broke!
This silent tongue shall plead for thee
When Time unveils eternity.

IV.

Say, did these fingers delve the mine?
Or with its envied rubies shine?
To hew the rock, or wear the gem,
Can little now avail to them.
But if the page of Truth they sought,
Or comfort to the mourner brought,
These hands a richer mead shall claim
Than all that wait on wealth or fame.

V.

Avails it whether bare or shod,
These feet the paths of duty trod?
If from the bowers of ease they fled,
To seek Affliction's humble shed;
If Grandeur's guilty bribe they spurned,
And home to Virtue's cot returned,
These feet with angel's wings shall vie,
And tread the palace of the sky.

—*Anonymous.*

DR JENNER, AND HIS DISCOVERY OF VACCINATION.

FEW of the many thousand ills which human flesh is heir to, have spread such devastation amongst the family of man, as small-pox. Its universality has ranged from the untold tribes of savages to the silken baron of civilisation; and its ravages on life and beauty have been shown in many a sad tale of domestic suffering. To stay the destroying hand of such a scourge, which by some has been identified with the Plague of Athens, was reserved for a genial spirit of our time: such a benefactor to his species was Edward Jenner, the discoverer of vaccination.

The great fact can, however, be traced half a century before Jenner's time. In the journal of John Byrom, F.R.S., under date June 3, 1725, it is recorded that—

"At a meeting of the Royal Society—Sir Isaac Newton presiding—Dr Jurin read a case of small-pox, where a girl who had been inoculated and had been vaccinated, was tried and had them not again; but another [a] boy, caught the small-pox from this girl, and had the confluent kind and died."

This case occurred at Hanover. The inoculation of the girl seems to have failed entirely; it was suspected that she had not taken the true small-pox: doubts, however, were removed, as a boy, who daily saw the girl, fell ill and died, "having had a very bad small-pox of the confluent sort." This is the first use of the word *Vaccination*, or more familiarly, cow-pox, which is an eruption arising from the insertion into the system of matter obtained from the eruption on the teats and udders of cows, and especially in Gloucestershire: it is also frequently denominated *vaccine matter;* and the whole affair, inoculation and its consequences, is called vaccination, from the Latin *vacca*, a cow.

The ravages which the small-pox formerly committed, are scarcely conceived or recollected by the present generation. An instance of death occurring after vaccination is now eagerly seized and commented upon; yet seventy years have not elapsed since this disease might fairly be termed the scourge of mankind, and an enemy more extensive and more insidious than even the plague. A family blighted in its fairest hopes through this terrible visitation was an every-day spectacle: the imperial House of Austria lost eleven of its offspring in fifty years. This instance is mentioned because it is historical; but in the obscure and unrecorded scenes of life this pest was often a still more merciless intruder.

Edward Jenner was the third son of the Vicar of Berkeley in Gloucestershire, where he was born May 17, 1749. Before he was nine years of age, he showed a growing taste for natural history, in forming a collection of the nests of the dormouse; and when at school at Cirencester, he was fond of searching for fossils, which abound in that neighbourhood. He was articled to a surgeon at Sudbury, near Bristol, and at the end of his apprenticeship came to London, and studied under John Hunter, with whom he resided as pupil for two years, and formed a lasting friendship with that great man. In 1773 he returned to his native village, and commenced practice as a surgeon and apothecary, with great success. Nevertheless, he abstracted from the fatigues of country practice sufficient time to form a museum of specimens of comparative anatomy and natural history. He was much liked, was a man of lively and simple humour, and loved to tell his observation of nature in homely verse; and in 1788 he communicated to the Royal Society his curious paper on the cuckoo. At the same time, he carried to London a drawing of the casual disease, as seen on the hands of the milkers, and showed it to Sir Everard Home and to others. John Hunter had alluded frequently to the fact in his lectures; Dr Adams had heard of the cow-pox both from Hunter and Cline, and mentions it in his *Treatise on Poisons*, published in 1795, three years previous to Jenner's own publication. Still, no one had the courage or the penetration to prosecute the inquiry except Jenner.

Jenner now resolved to confine his practice to medicine, and obtained, in 1792, a degree of M.D. from the University of St Andrews.

We now arrive at the great event of Jenner's life. While pursuing his professional education in the house of his master at Sudbury, a young countrywoman applied for advice; and the subject of small-pox being casually mentioned, she remarked, she could not take the small-pox because she had had cow-pox; and he then learnt that it was a popular notion in that district, that milkers who had been infected with a peculiar eruption which sometimes occurred on the udder of the cow, were completely secure against the small-pox. The medical gentlemen of the district told Jenner that the security which it gave was not perfect; and Sir George Baker, the physician, treated it as a popular error. But Jenner thought otherwise; and although John Hunter and other eminent surgeons disregarded the subject, Jenner pursued it. He found at Berkeley that some persons, to whom it was impossible to give small-pox by inoculation, had had cow-pox; but that others who had had cow-pox yet received small-pox. This led to the doctor's discovery, that the cow was subject to a certain eruption, which had the power of guarding from small-pox; and next, that it might be possible to propagate the cow-pox, and with it security from the small-pox, first from the cow to the human body, and thence from one person to another. Here, then, was an important discovery, that matter from the cow, intentionally inserted into the body, gave a slighter ailment than when received otherwise, and yet had the same effect of completely preventing small-pox. But of what advantage was it for mankind that the cows of Gloucestershire possessed a matter thus singularly powerful? How were persons living at a distance to derive benefit from this great discovery? Dr Jenner, having inoculated several persons from a cow, took the matter from the human vesicles thus produced, and inoculated others, and others from them again; thus making it pass in succession through many individuals, and all with the same good effect in preventing small-pox.

An opportunity occurred of making a trial of the latter on May 14th, 1796, (a day still commemorated by the annual festival at Berlin,) when a boy, aged eight years, was vaccinated with matter from the hands of a milkmaid; the experiment succeeded, and he was inoculated for small-pox on the 1st of July following without the least effect. Dr Jenner then extended his experiments, and in 1798 published his first memoir on the subject. He had originally intended to communicate his results to the Royal Society, but was admonished not to do so, lest it should injure the character which he had previously acquired among scientific persons by his paper on the natural history of the cuckoo. In the above work Dr Jenner announces the security against small-pox afforded by the true cow-pox, and also traces the origin of that disease in the cow to a similar affection of the heel of the horse.

The method, however, met with much opposition; until, in the following year, thirty-three leading physicians and forty eminent surgeons of London signed an earnest expression of their confidence in the efficacy of the cow-pox. The Royal Family of England exerted themselves to encourage Jenner: the Duke of Clarence, the Duke of York, the King, the Prince of Wales, and the Queen, bestowed great attention upon Jenner. The incalculable utility of cow-pox was at last evinced; and observation and experience furnished evidence enough to satisfy the Baillies and Heberdens, the Monros and Gregorys of Britain, as well as the physicians of Europe, India, and America. The new practice now began to supersede the old plan pursued by the small-pox hospital, which had been founded for inoculation. The two systems were each pursued until 1808, when the Hospital governors discontinued small-pox.

A committee of Parliament was now appointed to consider the claims of Jenner upon the gratitude of his country. It was clearly proved that he had converted into scientific demonstration a tradition of the peasantry. Two parliamentary grants of £10,000 and £20,000 were voted to him. In 1808 the National Vaccine Establishment was formed by Government, and placed under his direction. Honours were profusely showered upon him by various foreign princes, as well as by the principal learned bodies of Europe.

Dr Jenner passed the remainder of his years principally at Berkeley and at Cheltenham, continuing to the last his inquiries on the great object of his life. He died at Berkeley, in February 1823, at the green old age of seventy-four: his remains lie in the chancel of the parish church of Berkeley. A marble statue by Siever has been erected to his memory in the nave of Gloucester Cathedral; and another statue of him has been placed in a public building at Cheltenham. Five medals have been struck in honour of Jenner—three by the German nation; one by the surgeons of the British navy; and the fifth by the London Medical Society.

—TIMBS.

FOOT-BALL.

THE ball had just fallen again where the two sides are thickest, and they close rapidly around it in a scrummage; it must be driven through now by force or skill, till it flies out on one side or the other. Look how differently the boys face it! Here come two of the bull-dogs, bursting through the outsiders; in they go, straight to the heart of the scrummage, bent on driving that ball out on the opposite side. That is what they mean to do. My sons, my sons! you are too hot; you have gone past the ball, and must struggle now right through the scrummage, and get round and back again to your own side before you can be of any further use. Here comes young Brooke; he goes in as straight as you, but keeps his head, and backs and bends, holding himself still behind the ball, and driving it furiously when he gets the chance. Take a leaf out of his book, you young chargers. Here comes Speedicut, and Flashman the school-house bully, with shouts and great action. Won't you two come up to young Brooke, after locking-up, by the school-house fire, with "Old fellow, wasn't that just a splendid scrummage by the three trees?" But he knows you, and so do we. You don't really want to drive that ball through that scrummage, chancing all hurt for the glory of the school-house—but to make us think that 's what you want—a vastly different thing; and fellows of your kidney will never go through more than the skirts of a scrummage, where it 's all push and no kicking. We respect boys who keep out of it, and don't sham going in; but you—we had rather not say what we think of you.

Then the boys who are bending and watching on the outside, mark them—they are most useful players, the dodgers, who seize on the ball the moment it rolls out from amongst the chargers, and away with it across to the opposite goal; they seldom go into the scrummage, but must have more coolness than the chargers: as endless as are boys characters, so are their ways of facing or not facing a scrummage at foot-ball.

Three-quarters of an hour are gone; first winds are failing, and weight and numbers beginning to tell. Yard by yard the school-house have been driven back, contesting every inch of ground. The bull-dogs are the colour of mother earth from shoulder to ankle, except young Brooke, who has a marvellous knack of keeping his legs. The school-house are being penned in their turn, and now the ball is behind their goal, under the doctor's wall. The doctor and some of his family are there looking on, and seem as anxious as any boy for the success of the school-house. We get a minute's breathing time before old Brooke kicks out, and he gives the word to play strongly for touch, by the three trees. Away goes the ball, the bull-dogs after it, and in another minute there is a shout of "In touch," "Our ball." Now 's your time, old Brooke, while your men are still fresh. He stands with the ball in his hand, while the two sides form in deep lines opposite one another: he must strike it straight out between them. The lines are thickest close to him, but young Brooke and two or three of his men are shifting up further, where the opposite line is weak. Old Brooke strikes it out straight and strong, and it falls opposite his brother. Hurrah! that rush has taken it right through the school-line, and away past the three trees, far into their quarters, and young Brooke and the bull-dogs are close upon it. The school leaders rush back shouting, "Look out in goal," and strain every nerve to catch him, but they are after the fleetest foot in Rugby. There they go, straight for the school goal-posts, quarters scattering before them. One after another the bull-dogs go down, but young Brooke holds on. "He is down." No! a long stagger, but the danger is past; that was the shock of Crew, the most dangerous of dodgers. And now he is close to the school goal, the ball not three yards before him. There is a hurried rush of the school fags to the spot, but no one throws himself on the ball, the only chance, and young Brooke has touched it right under the school goal-posts.

The school leaders come up furious, and administer toco to the wretched fags nearest at hand; they may well be angry, for it is all Lombard Street to a China orange that the school-house kick a goal with the ball touched in such a good place. Old Brooke, of course, will kick it out, but who shall catch and place it? Call Crab Jones. Here he comes, sauntering along with a straw in his mouth, the queerest, coolest fish in Rugby; if he were tumbled into the moon this minute, he would just pick himself up without taking his hands out of his pockets, or turning a hair. But it is a moment when the boldest charger's heart beats quick. Old Brooke stands with the ball under his arm, motioning the school back; he will not kick out till they are all in goal, behind the posts; they are all edging forward, inch by inch, to get nearer for the rush at Crab Jones, who stands there in front of old Brooke to catch the ball. If they can reach and destroy him before he catches, the danger is over; and with one and the same rush they will carry it right away to the school-house goal. Fond hope! it is kicked out and caught beautifully. Crab strikes his heel to the ground, to mark the spot where the ball was caught, beyond which the school-line may not advance; but there they stand, five deep, ready to rush the moment the ball touches the ground. Take plenty of room! don't give the rush a chance of reaching you! place it true and steady! Trust Crab Jones—he has made a small hole with his heel for the ball to lie on, by which he is resting on one knee, with his eye on old Brooke. "Now!" Crab places the ball at the word, old Brooke kicks, and it rises slowly and truly as the school rush forward.

Then a moment's pause, while both sides look up at the spinning ball. There it flies, straight between the two posts, some five feet above the cross-bar, an unquestioned goal; and a shout of real genuine joy rings out from the school-house players-up, and a faint echo of it comes over the close from the goal-keepers under the doctor's wall. A goal in the first hour—such a thing hasn't been done in the school-house match this five years.

—*Tom Brown's School Days.*

ON A DISTANT PROSPECT OF ETON COLLEGE.

Ye distant spires, ye antique towers,
  That crown the watery glade,
Where grateful Science still adores
  Her Henry's holy shade;
And ye, that from the stately brow
Of Windsor's height th' expanse below
  Of grove, of lawn, of mead survey,
Whose turf, whose shade, whose flowers among
Wanders the hoary Thames along
  His silver-winding way.

Ah, happy hills! ah, pleasing shade!
  Ah, fields beloved in vain!
Where once my careless childhood stray'd,
  A stranger yet to pain!
I feel the gales that from ye blow
A momentary bliss bestow;
  As waving fresh their gladsome wing,
My weary soul they seem to soothe,
And, redolent of joy and youth,
  To breathe a second spring.

Say, Father Thames, for thou hast seen
  Full many a sprightly race
Disporting on thy margent green,
  The paths of pleasure trace;
Who foremost now delight to cleave,
With pliant arm, thy glassy wave?
  The captive linnet which enthral?
What idle progeny succeed
To chase the rolling circle's speed,
  Or urge the flying ball?

While some on earnest business bent
  Their murm'ring labours ply
'Gainst graver hours that bring constraint
  To sweeten liberty:
Some bold adventurers disdain
The limits of their little reign,

And unknown regions dare descry;
Still as they run they look behind,
They hear a voice in every wind,
And snatch a fearful joy.

Gay hope is theirs by fancy fed,
Less pleasing when possest;
The tear forgot as soon as shed,
The sunshine of the breast:
There 's buxom health of rosy hue,
Wild wit, invention ever new,
And lively cheer, of vigour born,
The thoughtless day, the easy night,
The spirits pure, the slumbers light,
That fly th' approach of morn.

Alas! regardless of their doom
The little victims play;
No sense have they of ills to come,
Nor care beyond to-day;
Yet see, how all around them wait
The ministers of human fate,
And black Misfortune's baleful train!
Ah, show them where in ambush stand,
To seize their prey, the murth'rous band!
Ah, tell them they are men!

These shall the fury Passions tear
The vultures of the mind,
Disdainful Anger, pallid Fear,
And Shame that skulks behind;
Or pining Love shall waste their youth,
Or Jealousy, with rankling tooth,
That only gnaws the secret heart;
And Envy wan, and faded Care,
Grim-visaged, comfortless Despair,
And Sorrow's piercing dart.

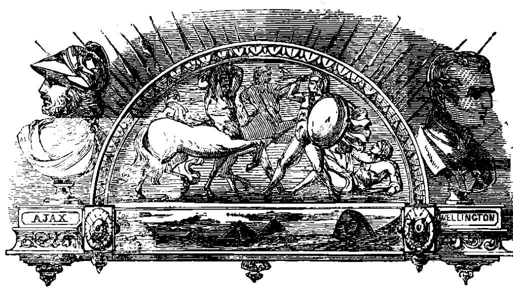
Ambition this shall tempt to rise,
Then whirl the wretch from high,
To bitter Scorn a sacrifice,
And grinning Infamy.

The stings of Falsehood those shall try,
And hard Unkindness' alter'd eye,
  That mocks the tear it forced to flow;
And keen Remorse with blood defiled,
And moody Madness laughing wild
  Amid severest woe.

Lo! in the vale of years beneath
  A grisly troop are seen,
The painful family of Death,
  More hideous than their queen:
This racks the joints, this fires the veins,
That every labouring sinew strains,
  Those in the deeper vitals rage:
Lo! Poverty, to fill the band,
That numbs the soul with icy hand,
  And slow-consuming Age.

To each his sufferings; all are men,
  Condemn'd alike to groan;
The tender for another's pain,
  Th' unfeeling for his own.
Yet ah! why should they know their fate,
Since sorrow never comes too late,
  And happiness too swiftly flies?
Thought would destroy their paradise.
No more;—where ignorance is bliss
  'Tis folly to be wise.

—GRAY.



THE HISTORICAL SCIENCES.

THERE is a book written by a celebrated judge of Nova Scotia, entitled "Nature and Human Nature." This title, apart altogether from the manner in which it is treated by the humorous author, will serve admirably to illustrate the distinction between the sciences with which we have thus far become acquainted, and those which are now to be introduced to our notice. Hitherto, in reviewing the Natural and Mathematical Sciences, we have dealt only with natural bodies and powers, the objects of what are termed the Physical, in contradistinction to the Historical Sciences. Since the first appearance of mankind upon this earth down to the present day, the objects of the Physical Sciences have undergone little or no change. The Nile, out of which the prophet Moses was taken, still flows in its accustomed course; the mountains, upon which Jerusalem reared her golden-crested towers, yet justify their title of the everlasting hills; the traveller in modern Greece is struck, at the present day, with the beauty of the atmosphere that Euripides extolled more than two thousand three hundred years ago; and the sunny vineyards, the peaceful flocks of ancient Italy, in no wise differ from those of more recent times. But it is altogether different in the case of the Historical Sciences. They tell a story of change, continual change; sweeping away old landmarks, and placing new ones where none stood before; tearing down old edifices, and building them anew from the very foundation; altering manners and customs, religion and laws; bringing arts, and sciences, and all learning, to the pitch of high perfection, or sinking them again into deep and lasting obscurity.

There is a new element, visibly, at work in all this. It cannot be matter; it must therefore be force. Change, we know, implies motion, and wherever there is motion there is force. But what force can this be that acts in so strange, so irregular a manner? The power that causes the stars to move in their orbits, that holds matter in its place, and drags water to seek its level, never changes; it always produces the same effects, and has done so from the beginning of the world. The power, then, that we are considering cannot be physical force. What is it? It is spiritual force; it is that which raises man far above the level of the brute creation and makes him godlike; the power of soul, and heart, and mind, acting upon and controlled by the human will.

In the great science of Zoology, there is a department that connects the Natural and the Historical Sciences; it is called Anthropology, or *a discourse about man.* It shows no respect of persons; does not study any particular man or kind of man; thinks no more of Alexander the Great, or the Governor-General, than it does of a prize-fighter or a chimney-sweep; and pays no attention to complexion, whether it be white, red, or black, so long as its owner is a man. The object of this science is to compare the human race with the lower animals, to trace their points of resemblance, and show wherein they differ. It is not very flattering, perhaps, to man's vanity to place him alongside of the Chimpanzee and the Gorilla, but when once the comparison has been made, he finds good reason to congratulate himself on the result. Instead of four crooked paws, he boasts the well-arched foot that enables him to stand erect as lord of creation, and the admirably-constructed hand with which he maintains his high position. The small brain, retreating forehead, and prominent jaws, he leaves to another race of beings, asserting for himself the sole use of language, and, above all, the possession of that inestimable gift, the human intellect. No solitary wanderer, but the most social of all beings, he seeks the society of his fellowmen, and, unimpeded by the highest mountain, the broadest seas, or the severest climate, he makes the whole world his home. It is with man thus distinguished from the brute creation, with man as an intelligent, social being, thinking, speaking, and acting, from year to year and from age to age, that the Historical Sciences have to deal. Not only man, however, but also the workmanship of his hands, and the influence of his mental and physical character, though seen and felt long ages after he himself has passed away, are the objects of the great department of knowledge which we are about to inspect.

The head of this great family of sciences, the one in which they all terminate, and from which they receive their name, is History. The Greek word *historia* simply means a *narrative* or *tale of what is known.* The duty of this science is to inquire into everything that has been transacted in the past. It brings before us the lives of men and of nations; the story of their great achievements in peace and war, in commerce and in art; their faith and their knowledge, their manners and customs; and all else that it can rescue from the devouring hand of time. But a mere jumble of all these is not true history. In order that the science may exist, there must be an order, a system in its arrangement, it must investigate causes and motives, and afford, not only the amusement which is provided by a well-written novel, but solid lessons of wisdom, a treasure of experience for guidance in the future. When a piece of history is confined to the life of a single individual it is called a Biography, or as the Greek term signifies, *the description of a life.* Were it not for history recording the knowledge that has been accumulated by our predecessors in former generations, the world could make no advances in arts or sciences, and would speedily relapse into hopeless barbarism. We thus perceive that it lies at the foundation of every description of learning, and deserves to be considered as, at least, the most useful of all the sciences.

History is, pre-eminently, the science of facts. Now the word *fact* comes to us from the Latin, and means *a thing done.* But all that is narrated, either in speech or in writing, is not fact; a great deal of it is fable. The Latin word *fable* and the Greek *myth* both meant originally *a tale* or *that which is said;* but the tales and sayings of the ancients were so very like what we at the present day would call *falsehoods,* that these terms received the signification of *a lying story.* These *lying stories,* however, were often used, as in the case of Æsop's fables, to illustrate some important moral lesson, and hence the words which characterized the whole class changed their meaning entirely. A myth is now defined as a narrative framed for the purpose of expressing some general truth, as a law of nature, a religious idea, &c. But whence do these myths arise? They arise at an early stage in the history of every country, when, as it were, the nation is in its infancy, and, like the child who imagines he hears the sea roaring in a shell, attempts to explain the mysteries of life and death by childish tales suited to the limited development of its mental powers. In all these myths, however, there is a sprinkling of truth, and sometimes it is worth while washing away all the sand of wickedness and absurdity, in order to get at the golden grains. Our Scripture narrative, for instance, is confirmed by the voice of almost every people, savage and civilized, on the face of the globe, for, under different names and disguises, their ancient legends have preserved the story of the great flood as it is recorded in the book of Genesis. You have, no doubt, heard of the false gods whom the ancient Greeks and Romans worshipped. The number of these and of their descendants is very great, and, concerning each of them, many myths have been handed down to us. You have also seen mention made of the Fairies, Satyrs, Centaurs, Dragons, Griffins, and other fabulous creatures of antiquity, such as never graced any modern museum or menagerie. Many learned men have studied the stories told of these gods, heroes, and monsters, and have drawn from a great mass of fable important germs of fact that have gradually developed into true narratives of considerable size. The study of these myths is called Mythology, which you will at once recognize as meaning *a discourse about myths or fables.* It is, of course, a much more difficult study than that of the history of facts, but, inasmuch as it supplies materials for a time of which no facts are regularly recorded, it is well worthy the attention even of the most superficial student of history.

Here, then, are two histories: the history of facts or history proper, and the history of fables or mythology. Now real history we have seen does not consist in a mere collection of facts without order, any more than a house consists in a scattered heap of bricks and mortar, or a book in several alphabets shaken together in a bag and put into type. There must be something to bind all the parts together, and make it one harmonious whole. There must, also, be something to help the memory in remembering the facts enumerated, and to assist the judgment in distinguishing one fact from another of a very similar kind. The something required and provided for by a special science is *time.* In the study of the Natural and Mathematical Sciences, time is not a common element; even when we do speak of it we use such terms as *space, length, duration of time,* and never designate a period, as, for instance, the year 1865. It is the special business of chronology or, as it is translated, *a discourse about time,* in connexion with the historical sciences, to treat of the regular divisions of time into periods of shorter or longer duration, and to keep a register of dates. The word *date* is of Latin origin, and signifies *a thing given or fixed,* because when time is applied to anything, that thing is fixed or determined, being thus marked off from all time before and after, in which otherwise it would, like a ship without a compass, soon be lost. Chronology enables us to take a panoramic view of all that has happened in the world during a certain period. It thus connects persons and facts that otherwise would never be brought into each others presence. What, for instance, had Solon, one of the seven sages of Greece, in common with Cyrus, the first king of Persia, except that the latter ascended the throne the same year in which the former died. Or, who would think of connecting General Wolfe and Frederic the Great of Prussia, were it not that the same year, 1758, witnessed a great victory for each of them. But it also serves to give us the ascending or descending scale of facts, either forward from any given point or date to the present day, or backwards from the said point to the dawn of history, arranging them in what is called chronological order. Chronology, also, does not confine itself to numbering hours, days, months, and years, but, for the greater convenience of the student of history, introduces larger divisions of time. Such are centuries, as the first century, the fifteenth, the nineteenth, &c., each of them including one hundred years. In order to enumerate these, and also to reckon the years themselves, it is necessary for this science to take a starting point. Thus the Jews count the years from the creation of man, Mussulmans from the flight of Mohammed from Mecca, and Christians from the birth of our Saviour. The ancient Greeks commenced with the year in which the Olympic games were established, and the Romans with that in which their city was founded. In this manner, you see, that the present year, calculated from all these different periods, would appear in no less than five forms. It is the duty of chronology, when it meets with these forms, to investigate them, and reduce them to some one sure and correct method, by which all difficulties in the way of the historian may be removed. It is unnecessary to say anything about the value of a science without which true history could not exist.

Times, however, are not the only points which it is necessary to mark and attend to in writing and reading history. There is another great element, without which a hardly less dangerous confusion would result, and that element is *place*. In the science of Geology, there is a department called Physical Geography, which treats of the natural features of the earth, such as its continents and oceans, islands and seas, lakes, rivers, peninsulas, mountains, plains, &c., never going beyond the limits of a natural science. But there is another kind of geography, called political, from a Greek word meaning *pertaining to a state*, because it has to do with those artificial divisions of the earth which are the work of man. Thus Europe, and Asia, Africa, Australia, North and South America are to the physical geographer, or, as the latter word means *describer of the earth*, four continents, the first two and the last two being united, and thus only forming one a piece. But to the political geographer, they are six great divisions of the habitable world, containing different races of people, divided into different states and provinces, and ruled over by a number of independent potentates. His duty is to mark off the bounds of each country, whether it be an empire or a kingdom, a province, a republic, or a savage tribe; to exhibit, also, the divisions of a country into districts and departments, counties and townships; to point out the cities, towns, and villages, scattered through them, with the mountains, rivers, and other natural features by which the district can be recognised. But these divisions and subdivisions are not always the same; the mountains and rivers, the continents, islands, and seas, do not change, but the whole of political geography may be overturned within a few hundred years. Many centuries ago, Assyria, Babylonia, and Phœnicia, were great and powerful states; to-day, they are desolate ruins, forming part of the Turkish empire. Four hundred years ago, the continent of America was unknown to the rest of the world, and inhabited by barbarian savages, except in Peru and Mexico, where a half-civilised race lived; and it is little more than one hundred years since the provinces of British America first appeared upon the page of history. Political geography, therefore, is historical in its nature; the geography of to-day is not that even of fifty years ago. How valuable, then, must a knowledge of this science, describing the political appearance of the world from the earliest times to the present day, with all its many changes, be to the student of history, and how necessary it is that every citizen of the world should be acquainted with the leading divisions into which his fellow-citizens have partitioned the surface of the earth.

From what we have now learned, it appears, that the historian must have a collection of facts to work upon, regularly arranged in chronological order, together with a knowledge of the places to which these facts relate. But this collection of facts does not come to him in a modern English book, such as you find your History of the World, of England, of Greece, or of Rome to be. Every country must provide this collection of facts pertaining to itself, and this it will naturally do in its own language. The number of known languages is fully nine hundred, so that, if each of these languages belonged to a country possessing a history, the task of writing the history of the world would be a labour which no single man could perform, nor, indeed, anything short of a very large number of the most learned men that the present advanced age could furnish. We must remember, however, that by far the greater number of these languages are spoken by savage or only half-civilised people, who, in reality, have nothing fit to be called history, since the life they lead, from year to year, and from generation to generation, is as uniform and monotonous as that of an animal or a plant. Of the languages that remain, some are ancient and others modern. The tongues of ancient India and Persia, Greece and Rome, with many others, are called *dead languages;* for they are no more used in common life, but are the special property of the scholar. The speech of our Anglo-Saxon, and that of our Norman forefathers, have gradually faded away into the English and French of modern times, while the old Gothic has become the German, and many Indian tongues have altogether disappeared from the lips of the Red Men of America. Of civilised languages, however, in which the annals of former days are written, or in which we can gain a knowledge of the present, there are sufficient, and more than sufficient, to occupy the life-time of any scholar bold enough to attempt the study of them. The science which investigates all these languages, that classifies them according to their resemblances, that traces their origin and connexion with each other, is called Philology, or, as the Greek words of which it is composed mean, *the love of language.* In one of the branches of this science, you will recognise an old friend—grammar. Now language consists of two things, the mere words forming what is called the vocabulary, and which we will designate *the matter*, and grammar, which we will call *the form.* Just as the pile of bricks and mortar, which constitute the matter out of which the house is built, without the labour of bricklayers and masons, would never become a house at all, so the vocabulary, without grammar, would never make a language. Grammar, viewed in this light, is an interesting study, and it becomes much more so when the command of other languages besides our own enables us to compare their respective grammars. Attached to the science of philology is one of very recent date, called the Science of Language. The object of this science is not to inquire into the nature of different languages, and to study these for their own sake, but to make a deeper inquiry still, and to find the nature and origin of language in general. It seeks to trace languages up to their birthplace, to account for there being such a number of them in existence, and to discover how men first came to employ that speech of which brutes are incapable.

So far as written documents exist, or verbal communications can be obtained, a knowledge of languages is of the greatest value to the historian. But there are times, far back in the early history of every country, of which no such information can be had. People were all too busy in these ancient times, or too ignorant, to be able to record their sayings and doings; or, perhaps, the records which they made, perished or were lost. However, the historian cannot content himself with passing over these primitive periods in the life of every nation. He must find some way of learning a little about these times. The only way that remains open to him is to study the works which the people, who lived in these ages of darkness, left behind them. In Egypt he finds the immense pyramids; in the Mississippi Valley he discovers the great regular heaps of the Mound-builders; in every civilised country of the Old World, ruins of various kinds meet his eye continually; and there is not an Indian grave or battle-field which he examines that does not furnish him with pages of history in old tomahawks, flint arrowheads, copper kettles, and other relics of bygone ages. The science which undertakes the examination, determination, and classification of such relics as these, and which, from the materials thus supplied, confirms the records of a nation's infancy, or fills up the vacant pages of pre-historic eras, is called archæology, or, *a discourse about antiquities.* A subordinate science, of which the special duty is to draw such information from the figures, characters, and inscriptions of ancient coins and medals, is termed Numismatics, a Greek word meaning, *things pertaining to coins.* The true home of the science of archæology is, undoubtedly, to be found in old settled countries; yet upon this continent, the scientific antiquary will find, in the relics of old Indian races, ample fields of interest and instruction.

While the historian is thus engaged collecting narratives of fact, separating the fine dust of truth from the coarse mass of ancient fable, settling dates and arranging his materials in their order of time; while he is surveying the political world at different periods of its existence, poring over grammars and vocabularies of all nations, and delving deep into the mines of antiquity; what a vast variety of human life must exhibit itself to him, what a strange assemblage of men of all colours, and forms, and characters, must fall within the sphere of his observation! Now, when his thoughts go back to the cradle-land of our race, he sees, before his mind's eye, the fierce and impetuous but effeminate Asiatic, the proud and exclusive Jew, and the accomplished Egyptian. Again he looks upon more western lands, and the polished Greek, the valorous Roman, the treacherous Carthagenian, are present with him. Later, the tall, fair-haired, blue-eyed Goth; the savage, flat-nosed Hun; the turbulent, restless Frank; the wild, plundering Norseman, and the brave, wily Saracen, are the foreground of a varied and changing scene. And now, who shall enumerate them all? white men and black, red Indians and yellow Chinamen, fierce Malays and peaceful Sandwich Islanders, Esquimaux and Patagonians, are but a few among the many families into which the great human race is divided. There are questions to be asked concerning all these, and concerning the family of mankind in general, that are as interesting as they are difficult of solution. We know that the greater number of these races have not always been found in the places which they now inhabit. Before we, or our ancestors, came to this continent, it was inhabited by Indian tribes. But what people did they displace? Where did they come from? Then again, how does it happen that there are such diversities of colour and form, of language and character, among men? Has this diversity always been the case? We say—no; for the Bible assures us that we are all descended from the same first parents, that we are all brothers in spite of our want of a family likeness. Then, when did it happen, and how? How many are the varieties of mankind? Had climate anything to do with change of colour? To what family do we belong? Have any families perished altogether? All these are interesting questions, and the science which attempts to answer them is called Ethnology, or *a discourse about nations.*

We have come at last to the end of our review of the Historical Sciences. In them we find a new element, and that element is man. The other sciences may excite our wonder and admiration; they may fill us with a feeling of astonishment and awe under a sense of the greatness and the wisdom of Him who has created all the objects of which they treat, and whose constant care keeps them in being and activity. But they cannot thrill our hearts, they cannot excite our imaginations, nor can they awake in our bosoms such sympathy and enthusiasm as are aroused by the story of our own race, and by all that bears upon the past history of mankind on this earth. All the lives of men and of nations, of the good and the bad, the wise and the unwise, have not been preserved in vain, or merely for our temporary gratification. They are just as much lessons of warning and encouragement as the works of nature are lessons of adoration, humility, and gratitude; and coming nearer home to our affections than all other earthly teaching, it becomes us to ponder them well, and to weigh our own lives in the scale of impartial history, so that they may live in a better story when the annals of time are closed for ever.

Historical Sciences.

1. History.	4. Political Geography.
2. Mythology.	5. Philology.
3. Chronology.	6. Archæology.
7. Ethnology.	

MYTHOLOGY—INDIAN MYTHOLOGY.

MON-DAW-MIN; OR, THE ORIGIN OF INDIAN CORN.

In times past, a poor Indian was living with his wife and children in a beautiful part of the country. He was not only poor but inexpert in procuring food for his family, and his children were all too young to give him assistance. Although poor, he was a man of a kind and contented disposition. He was always thankful to the Great Spirit for everything he received. The same disposition was inherited by his eldest son, who had now arrived at the proper age to undertake the ceremony of Ke-ig-uish-im-o-win, or fast, to see what kind of a spirit would be his guide and guardian through life. Wunzh, for this was his name, had been an obedient boy from his infancy, and was of a pensive, thoughtful, and mild disposition, so that he was beloved by the whole family. As soon as the first indications of spring appeared, they built him the customary little lodge at a retired spot, some distance from their own, where he would not be disturbed during this solemn rite. In the meantime he prepared himself, and immediately went into it, and commenced his fast. The first few days he amused himself in the mornings by walking in the woods and over the mountains, examining the early plants and flowers, and in this way prepared himself to enjoy his sleep, and, at the same time, stored his mind with pleasant ideas for his dreams. While he rambled through the woods, he felt a strong desire to know how the plants, herbs, and berries grew, without any aid from man, and why it was that some species were good to eat, and others possessed medicinal or poisonous juices. He recalled these thoughts to mind after he became too languid to walk about, and had confined himself strictly to the lodge; he wished he could dream of something that would prove a benefit to his father and family, and to all others. "True!" he thought, "the Great Spirit made all things, and it is to Him that we owe our lives. But could He not make it easier for us to get our food than by hunting animals and taking fish? I must try to find out this in my visions."

On the third day he became weak and faint, and kept his bed. He fancied, while thus lying, that he saw a handsome young man coming down from the sky, and advancing towards him. He was richly and gaily dressed, having on a great many garments of green and yellow colours, but differing in their deeper or lighter shades. He had a plume of waving feathers on his head, and all his motions were graceful.

"I am sent to you, my friend," said the celestial visitor, "by that Great Spirit who made all things in the sky and on the earth. He has seen and knows your motives in fasting. He sees that it is from a kind and benevolent wish to do good to your people, and to procure a benefit for them, and that you do not seek for strength in war or the praise of warriors. I am sent to instruct you, and show you how you can do your kindred good." He then told the young man to arise, and prepare to wrestle with him, as it was only by this means that he could hope to succeed in his wishes. Wunzh knew he was weak from fasting, but he felt his courage rising in his heart, and immediately got up, determined to die rather than fail. He commenced the trial, and after a protracted effort was almost exhausted, when the beautiful stranger said, "My friend, it is enough for once; I will come again to try you;" and, smiling on him, he ascended in the air in the same direction from which he came. The next day, the celestial visitor reappeared at the same hour and renewed the trial. Wunzh felt that his strength was even less than the day before, but the courage of his mind seemed to increase in proportion as his body became weaker. Seeing this, the stranger again spoke to him in the same words he used before, adding, "To-morrow will be your last trial. Be strong, my friend, for this is the only way you can overcome me, and obtain the boon you seek." On the third day he again reappeared at the same time, and renewed the struggle. The poor youth was very faint in body, but grew stronger in mind at every contest, and was determined to prevail or perish in the attempt. He exerted his utmost powers, and after the contest had been continued the usual time, the stranger ceased his efforts, and declared himself conquered. For the first time he entered the lodge, and, sitting down beside the youth, began to deliver his instructions to him, telling him in what manner he should proceed to take advantage of his victory.

"You have now your desires of the Great Spirit," said the stranger. "You have wrestled manfully. To-morrow will be the seventh day of your fasting. Your father will give you food to strengthen you, and as it is the last day of trial you will prevail. I know this, and now tell you what you must do to benefit your family and tribe. To-morrow," he repeated, "I shall meet you and wrestle with you for the last time; and as soon as you have prevailed against me, you will strip off my garments and throw me down, clean the earth of roots and weeds, make it soft, and bury me in the spot. When you have done this, leave my body in the earth, and do not disturb it, but come occasionally to visit the place, to see whether I have come to life, and be careful never to let the grass or weeds grow on my grave. Once a-month cover me with fresh earth. If you follow my instructions, you will accomplish your object of doing good to your fellow-creatures, by teaching them the knowledge I now teach you." He then shook him by the hand and disappeared.

In the morning, the youth's father came with some slight refreshment, saying, "My son, you have fasted long enough. If the Great Spirit will favour you, he will do it now. It is seven days since you have tasted food, and you must not sacrifice your life. The master of life does not require that." "My father," replied the youth, "wait till the sun goes down. I have a particular reason for extending my fast to that hour." "Very well," said the old man, "I shall wait till the hour arrives, and you feel inclined to eat."

At the usual hour of the day the sky-visitor returned, and the trial of strength was renewed. Although the youth had not availed himself of his father's offer of food, he felt that new strength had been given to him, and that exertion had renewed his strength and fortified his courage. He grasped his angelic antagonist with supernatural strength, threw him down, took from him his beautiful garments and plume, and, finding him dead, immediately buried him on the spot, taking all the precautions he had been told of, and being very confident, at the same time, that his friend would again come to life. He then returned to his father's lodge, and partook sparingly of the meal that had been prepared for him. But he never for a moment forgot the grave of his friend. He carefully visited it throughout the spring, and weeded out the grass, and kept the ground in a soft and pliant state. Very soon he saw the top of the green plumes coming through the ground; and the more careful he was to obey his instructions in keeping the ground in order, the faster they grew. He was, however, careful to conceal the exploit from his father. Days and weeks had passed in this way. The summer was now drawing towards a close, when one day, after a long absence in hunting, Wunzh invited his father to follow him to the quiet and lonesome spot of his former fast. The lodge had been removed, and the weeds kept from growing on the circle where it stood, but in its place stood a tall and graceful plant, with bright-coloured silken hair, surmounted with nodding plumes and stately leaves, and golden clusters on each side. "It is my friend," shouted the lad; "it is the friend of all mankind. It is *Mondawmin*. We need no longer rely on hunting alone; for, as long as this gift is cherished and taken care of, the ground itself will give us a living." He then pulled an ear. "See, my father," said he, "this is what I have fasted for. The Great Spirit has listened to my voice, and sent us something new, and, henceforth, our people will not alone depend upon the chase or upon the waters."

He then communicated to his father the instructions given him by the stranger. He told him that the broad husks must be torn away, as he had pulled off the garments in his wrestling; and, having done this, directed him how the ear must be held before the fire till the outer skin became brown, while all the milk was retained in the grain. The whole family then united in a feast on the newly-grown ears, expressing gratitude to the merciful Spirit who gave it. So corn came into the world.

—SCHOOLCRAFT.

LINES WRITTEN ON PASSING DEAD-MAN'S ISLAND,

ONE OF THE MAGDALEN GROUP, IN THE GULF OF ST LAWRENCE.

SEE you, beneath yon cloud so dark,
Fast gliding along, a gloomy bark?
Her sails are full, though the wind is still,
And there blows not a breath her sails to fill!

Oh! what doth that vessel of darkness bear?
The silent calm of the grave is there,
Save now and again a death knell rung,
And the flap of the sails with night fog hung!

There lieth a wreck on the dismal shore
Of cold and pitiless Labrador;
Where, under the moon, upon mounts of frost,
Full many a mariner's bones are tost!

Yon shadowy bark hath been to that wreck,
And the dim blue fire that lights her deck,
Doth play on as pale and livid a crew,
As ever yet drank the churchyard dew!

To Dead-Man's Isle, in the eye of the blast,
To Dead-Man's Isle, she speeds her fast;
By skeleton shapes her sails are furl'd,
And the hand that steers is not of this world!

Oh! hurry thee on—oh! hurry thee on,
Thou terrible bark! ere the night be gone,
Nor let morning look on so foul a sight,
As would blanch for ever her rosy light!

—Moore.

THE LOTUS-EATERS.

Among the chief of the Achæans who fought before the walls of Ilion, there was none who gained for himself a greater glory than Odysseus, the son of Laertes. Brave he was in battle, and steadfast in danger; but, most of all did the Achæans seek his aid and counsel when great things had to be weighed and fixed. And so it was, that in every peril where there was need of the wise heart and the ready tongue, all hastened to Odysseus, and men felt that he did more to throw down the kingdom of Priam than the mightiest chieftains who fought only with sword and spear.

Yet, in the midst of all his toil, and all his great exploits in the land of Ilion, the heart of Odysseus was far away on rocky Ithaca, where his wife Penelope dwelt with his young son Telemachus. Many a time, as the weary years of the war rolled on, he said within himself: "Ah, when will the strife be ended, and when shall we spread our sails to the breeze, and speed on our way homewards over the dark-blue sea?" At last the doom of Paris was accomplished, and the hosts of Agamemnon gave the city of Ilion to fire and sword. When Odysseus hastened to gather his men together, that they might go to their home in Ithaca, they dragged the ships down to the sea from the trenches, where they had so long lain idle; but before they sat down to row the ships out to the deep water, Odysseus spake to them, and said: "O friends, think now, each one of you, of his home, of his wife, and of his children. Ten times have summer and winter passed over us since we left them with cheerful hearts, thinking that in but a little time we should come back to them laden with glory and booty. Ten years have they mourned for us at home; and we, who set out for Ilion in the vigour of manhood, go back now with gray hairs, or bowed down with our weary labours. Yet faint not, O friends, neither be dismayed. Think how they wait and long for you still at home; and as we go from land to land in our voyage to rocky Ithaca, let not weariness weigh down your hearts, or things fair and beautiful lead you to seek your rest, till our ships are moored in the haven which we left ten years ago."

With shouts of joy they sat down to their long oars, and when they had rowed the ships out into the open sea, they spread the white sails to the breeze, and watched the Ilion land as it faded away from their sight in the far distance. For many a day they went towards the land of the setting sun, until a mighty wind from the north drove them to a strange country, far out of their course to Ithaca. Fair it was and peaceful beyond all lands which they had seen. The sun looked down out of the cloudless heaven on fruits and flowers which covered the laughing earth. Far away beyond the lotus plains, the blue hills glimmered in a dreamy haze. The trees bowed their heads in a peaceful slumber, and the lagging waves sank lazily to sleep upon the sea-shore. The summer breeze breathed its gentle whisper through the air, and the birds sang listlessly of their loves from the waving groves. Then said the men of Odysseus to one another: "Would that our wives and our children were here! Truly, Ithaca is but a rough and barren land, and a sore grief it is to leave this happy shore to go home, and there find, it may be, that our children remember us no more." And Odysseus said within himself: "Surely some strange spell is in this fair land—almost might I long to sit down and sleep on the shore for ever; but Penelope waits for me in my home, and I cannot rest till I see her face once more." Then he bade three of his men go forth and ask the name of the land, and of the men who lived in it. So they went slowly from the beach, where the waves sang their lulling song to the sleepy flowers, and they wandered along the winding stream which came from the glimmering hills far away, till deep down in a glen where the sun shed but half its light, they saw men with fair maidens reclining on the soft grass, under the shade of the pleasant palm-trees. Before them was spread a banquet of rich and rosy fruit, and some were eating, and others lay asleep. Then the men of Odysseus went up to them, and sat down by their side; for they feared them not, as men are wont to fear the people of a strange land. They asked not their name, for they remembered not the bidding of Odysseus; but they drank the dark wine, and ate of the rosy fruit which the fair maidens held out to them. "Eat," they said, "O strangers, of the fruit which kills all pain; surely ye are weary, and your hearts are faint with sorrow, and your eyes are dim as with many tears. Eat of our fruit, and forget your labours; for all who eat of it remember weary toil, and strife, and war no more." So they ate of the fruit, and then over their senses stole softly a strange and wondrous sleep, so that they saw, and heard, and spake even while they slumbered. On their ears fell the echo of a dreamy music, and forms of maidens, fair as Aphrodite when she rose from the sea-foam, passed before their eyes; and they said to one another: "Here let us sit and feast, and dream for ever."

Long time Odysseus waited on the sea-shore, and less and less he marvelled that they came not back, for he felt that over his own heart the strange spell was falling; and he said: "Ah, Penelope, dearer to me than aught else on the wide earth, the gods envy me thy love, else would they not seek to beguile me thus in this strange land of dreams and slumber." So he rose up, as one rises to go forth to battle, and he went quickly on the path by which his men had gone before him. Presently, he saw them in the deep dell, and the rich fruit of the lotus was in their hand. They then called to Odysseus, and said: "We have come to the land of the lotus-eater; sit thou down with us, and eat of their fruit, and forget all thy cares for ever!" But Odysseus answered not, and hastening back, he bade the others come with him, and bind the three men, and carry them to the ship. "Heed not the people of the land," he said, "nor touch their rosy fruit. It were a shame for men who have fought at Ilion to slumber here, like swine fattening for their slaughter."

So they hastened and bound the three men who sat at the banquet of the lotus-eaters; and they heeded not their words as they besought them to taste of their fruit, and forget all their misery and trouble. And Odysseus hurried them back to the shore, and made them drag down the ships into the sea, and sit down to their long oars. "Hasten, O friends, hasten," he said, "from this land of dreams! Hither come the lotus-eaters, and their soft voices will beguile our hearts if we tarry longer, and they will tempt us to taste of their fruit; and then we shall seek no more to go back again to the land of toiling men.

Then the dash of their oars broke the calm of the still air, and roused the waters from their gentle slumber, as they toiled on their weary way. Further and further they went, but still the echo, as of faint and lulling music, fell upon their ear, and they saw fair forms of maidens roam listlessly on the shore. And when they had rowed the ship further out into the sea, still the drooping palm-trees seemed to beckon them back to slumber, as they bowed their heads over the flowers which slept in the shade beneath them; and a deeper peace rested on the lotus-land as the veil of evening fell gently on the plain, and the dying sun kissed the far-off hills.

—Cox's *Mythology*.

THE LOTUS-EATERS.

"COURAGE!" he said, and pointed toward the land;
"This mounting wave will roll us shoreward soon."
In the afternoon they came unto a land,
In which it seemèd always afternoon.
All round the coast the languid air did swoon,
Breathing like one that hath a weary dream.
Full-faced above the valley stood the moon;
And like a downward smoke, the slender stream
Along the cliff to fall, and pause, and fall did seem.

A land of streams! some, like a downward smoke,
Slow dropping veils of thinnest lawn did go;
And some through wavering lights and shadows broke,
Rolling a slumb'rous sheet of foam below.
They saw the gleaming river seaward flow
From the inner land: far off, three mountain-tops,
Three silent pinnacles of aged snow,
Stood sun-set flushed: and dew'd with showery drops,
Up-climb the shadowy pine above the woven copse.

The charm'd sunset linger'd low adown
In the red West: through mountain clefts the dale
Was seen far inland, and the yellow down
Border'd with palm, and many a winding vale,

And meadow, set with slender galingale;
A land where all things always seem'd the same!
And round about the keel with faces pale,
Dark faces pale against that rosy flame,
The mild-eyed, melancholy lotus-eaters came.

Branches they bore of that enchanted stem,
Laden with flower and fruit, whereof they gave
To each, but whoso did receive of them,
And taste, to him the gushing of the wave
Far, far away, did seem to mourn and rave
On alien shores; and if his fellow spake,
His voice was thin, as voices from the grave;
And deep asleep he seem'd, yet all awake,
And music in his ears his beating heart did make.

They sat them down upon the yellow sand,
Between the sun and moon upon the shore;
And sweet it was to dream of fatherland—
Of child, and wife, and slave; but evermore
Most weary seem'd the sea, weary the oar,
Weary the wandering fields of barren foam.
Then some one said, "We will return no more;
And all at once they sang, "Our island home
Is far beyond the wave; we will no longer roam."

—TENNYSON.

HISTORY—BATTLE OF MARATHON.

To the left of the Athenians was a low chain of hills, clothed with trees: to their right, a torrent. Their front was long; for to render it more imposing in extent, and to prevent being out-flanked by the Persian numbers, the centre ranks were left weak and shallow, but on either wing the troops were drawn up more solidly and strong. Callimachus commanded the right wing; the Platæans formed the left; the whole was commanded by Miltiades. They had few, if any, horsemen or archers.

The details which we possess of their arms and military array, if not in this, in other engagements of the same period, will complete the picture. We may behold them clad in bright armour of good proof and well-tempered, which covered breast and back; the greaves, so often mentioned by Homer, were still retained; their helmets were wrought and crested, the cones mostly painted in glowing colours, and the plumage of feathers, or horse-hair, rich and waving in proportion to the rank of the wearer. Broad, sturdy, and richly ornamented were their bucklers, the pride and darling of their arms, the loss of which was the loss of honour. Their spears were ponderous, thick, and long, (a chief mark of contradistinction from the light shaft of Persia), and, with their short broad-sword, constituted their main weapons.

No Greek army marched to battle without vows and sacrifice and prayer, and now, in the stillness of the pause, the divine rites were solemnised. Loud broke the trumpets; the standards, wrought with the sacred bird of Athens, were raised on high: it was the signal of battle, and the Athenians rushed with an impetuous vehemence upon the Persian power. "They were the first Greeks of whom I have heard," says the historian, "who ever *ran* to attack a foe; the first, too, who ever beheld without dismay the garb and armour of the Medes; for, hitherto in Greece, the very name of Mede had excited terror."

When the Persian army, with its numerous horse, (animals as well as man protected by coats of mail,) its expert bowmen, its lines and deep files of turbaned soldiers, gorgeous with many a blazing standard, headed by leaders well hardened, despite their gay garbs and adorned breast-plates, in many a more even field; when, I say, this force beheld the Athenians rushing toward them, they considered them, thus few and destitute alike of cavalry and archers, as madmen hurrying to destruction. But it was evidently not without deliberate calculation that Miltiades had so commenced the attack. The warlike experience of his guerilla life had taught him to know the foe against whom he fought. To volunteer the assault, was to forestall and cripple the charge of the Persian horse; besides, the long lances, the heavy arms, the hand-to-hand valour of the Greeks, must have been no light encounter to the more weakly mailed and less formidably armed infantry of the east. Accustomed themselves to give the charge, it was a novelty and a disadvantage to receive it.

Long, fierce, and stubborn was the battle. The centre wing of the barbarians, composed of the Sacians and the pure Persian race, at length pressed hard upon the shallow centre of the Greeks, drove them back into the country, and, eager with pursuit, left their own wings to the charge of Callimachus on the one side, and the Plateau forces on the other. The brave Callimachus, after the most signal feats of valour, fell fighting in the field; but his troops, undismayed, smote on with spear and sword.

The barbarians retreated backward to the sea, where swamps and marshes encumbered their movements; and here, though the Athenians did not pursue them far, the greater portion were slain, hemmed in by the morasses, and probably ridden down by their own disordered cavalry. Meanwhile, the two tribes that had formed the centre, one of which was commanded by Aristides, retrieved themselves with a mighty effort; and the two wings having routed their antagonists, now in closing toward each other, intercepted the barbarian centre; which, thus attacked in front and rear, was defeated with prodigious slaughter.

Evening came on: confused and disorderly, the Persians now only thought of flight; the whole army retired to their ships, hard chased by the Grecian victors, who, amid the carnage, fired the fleet. Cynegirus, brother to Æschylus the tragic poet, (himself highly distinguished for his feats that day,) seized one of the vessels by the poop: his hand was severed by an axe: he died gloriously of his wounds. But to none did the fortunes of that field open a more illustrious career than to a youth of the tribe of Leontes, in whom, though probably then but a simple soldier in the ranks, were first made manifest the nature and the genius destined to command. The name of that youth was THEMISTOCLES.

Seven vessels were captured, six thousand four hundred of the barbarians fell in the field. The Athenians and their brave allies lost only one hundred; but among them perished many of their bravest nobles. It was a superstition not uncharacteristic of that imaginative people, and evincing how greatly their ardour was aroused, that many of them fancied they beheld the gigantic shade of their ancestral Theseus, completely armed, and bearing down before them upon the foe!

A picture of the battle, representing Miltiades, in the foremost place, and solemnly preserved in public, was deemed no inadequate reward to that great captain; and yet, conspicuous above the level plain of Marathon, rises a long barrow, fifteen feet in height, the supposed sepulchre of the Athenian heroes. Still does a romantic legend, not unfamiliar with our traditions of the North, give a supernatural terror to the spot. Nightly, along the plains are yet heard by superstition the neighing of chargers and the rushing shadows of spectral war. And still, throughout the civilised world, (civilised how much by the art and lore of Athens!) men of every clime, of every political persuasion, feel as Greeks at the battle of Marathon. Later fields have presented the spectacle of an equal valour, and almost the same disparities of slaughter; but never, in the annals of the earth, were united so closely in our applause, admiration for the heroism of the victors, and sympathy for the holiness of their cause. —BULWER.

THE DEFENCE OF THE BRIDGE AGAINST THE TUSCAN ARMY.

Now the Consul's brow was sad;
And the Consul's speech was low,
And darkly look'd he at the wall,
And darkly at the foe.
"Their van will be upon us
Before the bridge goes down;
And if they once may win the bridge,
What hope to save the town?"

Then out spake brave Horatius,
The captain of the gate—
"To every man upon this earth
Death cometh soon or late.
And how can man die better
Than facing fearful odds,
For the ashes of his fathers,
And the temples of his gods.

. . . .

"Hew down the bridge, Sir Consul,
With all the speed ye may;
I, with two more to help me,
Will hold the foe in play.
In yon strait path a thousand
May well be stopp'd by three;
Now who will stand on either hand,
And keep the bridge with me?"

Then out spake Spurius Lartius,
A Ramnian proud was he,
"Lo, I will stand at thy right hand,
And keep the bridge with thee."
And out spake strong Herminius,
Of Titian blood was he,
"I will abide on thy left side,
And keep the bridge with thee."

"Horatius," quoth the Consul,
"As thou sayest, so let it be."
And straight against that great array
Forth went the dauntless three.
For Romans in Rome's quarrel
Spared neither land nor gold,
Nor son, nor wife, nor limb, nor life,
In the brave days of old. . . .

Now, while the three were tightening
Their harness on their backs,
The Consul was the foremost man
To take in hand an axe.
And fathers mix'd with commons,
Seized hatchet, bar, and crow,
And smote upon the planks above,
And loosed the props below.

Meanwhile the Tuscan army,
Right glorious to behold,
Came flashing back the noonday light,
Rank behind rank, like surges bright
Of a broad sea of gold.
Four hundred trumpets sounded
A peal of warlike glee,
As that great host, with measured tread,
And spears advanced, and ensigns spread,
Roll'd slowly towards the bridge's head,
Where stood the dauntless three.

The three stood calm and silent,
And looked upon the foes,
And a great shout of laughter
From all the vanguard rose.
And forth three chiefs came spurring
Before that deep array;
To earth they sprang, their swords they drew,
And lifted high their shields, and flew
To win the narrow way. . . .

Stout Lartius hurl'd down Aruns
Into the stream beneath;
Herminius struck at Senis,
And clove him to the teeth.
At Picus brave Horatius
Darted one fiery thrust,
And the proud Umbrian's gilded arms
Clash'd in the bloody dust. . . .

But hark, the cry is Astur!
And lo! the ranks divide;
And the great lord of Luna
Comes with his stately stride.
Upon his ample shoulders
Clangs loud the four-fold shield,
And in his hand he shakes the brand
Which none but he can wield.

He smiled on those bold Romans,
A smile serene and high;
He eyed the flinching Tuscans,
And scorn was in his eye.
Quoth he, "The she-wolf's litter
Stand savagely at bay;
But will ye dare to follow
If Astur clears the way?"

Then, whirling up his broadsword
With both hands to the height,
He rush'd against Horatius,
And smote with all his might.
With shield and blade Horatius
Right deftly turn'd the blow;
The blow, though turn'd, came yet too nigh,
It miss'd his helm, but gash'd his thigh:
The Tuscans raised a joyful cry,
To see the red blood flow.

He reel'd, and on Herminius
He lean'd one breathing space;
Then, like a wild-cat mad with wounds,
Sprang right at Astur's face.
Through teeth, and skull, and helmet,
So fierce a thrust he sped,
The good sword stood a handbreadth out
Behind the Tuscan's head.

And the great lord of Luna
Fell at that deadly stroke,
As falls on Mount Alvernus
A thunder-smitten oak.
Far o'er the crushing forest
The giant arms lie spread;
And the pale augurs, muttering low
Gaze on the blasted head.

. . . .

But meanwhile axe and lever
Have manfully been plied;
And now the bridge hangs tottering
Above the boiling tide.
"Come back, come back, Horatius!"
Loud cried the fathers all,
"Back Lartius! back Herminius!
Back, ere the ruin fall!"

Back darted Spurius Lartius;
Herminius darted back;
And, as they press'd, beneath their feet
They felt the timbers crack.
But when they turn'd their faces,
And on the further shore
Saw brave Horatius stand alone,
They would have crossed once more.

But with a crash like thunder
Fell every loosen'd beam,
And, like a dam, the mighty wreck
Lay right athwart the stream.
And a long shout of triumph
Rose from the walls of Rome,
As to the highest turret tops
Was splash'd the yellow foam.

Alone stood brave Horatius,
But constant still in mind;
Thrice thirty thousand foes before,
And the broad flood behind.
"Down with him:" cried false Sextus,
With a smile on his pale face;
"Now yield thee," cried Lars Porsena,
"Now yield thee to our grace."

Round turn'd he, as not deigning
Those craven ranks to see;
Nought spake he to Lars Porsena,
To Sextus nought spake he;
But he saw on Palatinus
The white porch of his home;
And he spake to the noble river
That rolls by the towers of Rome.

"O Tiber! father Tiber!
To whom the Romans pray,
A Roman's life, a Roman's arms,
Take thou in charge this day!"
So he spake, and speaking, sheathed
The good sword by his side,
And, with the harness on his back,
Plunged headlong in the tide.

No sound of joy or sorrow
Was heard from either bank;
But friends and foes in dumb surprise,
With parting lips and straining eyes,
Stood gazing where he sank.
And when above the surges
They saw his crest appear,
All Rome sent forth a rapturous cry;
And even the ranks of Tuscany
Could scarce forbear to cheer.

But fiercely ran the current,
Swollen high by months of rain,
And fast his blood was flowing,
And he was sore in pain,
And heavy with his armour,
And spent with changing blows;
And oft they thought him sinking,
But still again he rose.

Never, I ween, did swimmer
In such an evil case,
Struggle through such a raging flood
Safe to the landing-place.
But his limbs were borne up bravely,
By the brave heart within,
And our good father Tiber
Bore bravely up his chin.

And now he feels the bottom;
Now on dry earth he stands;
Now round him throng the fathers
To press his gory hands.
And now, with shouts and clapping,
And noise of weeping loud,
He enters through the river-gate,
Borne by the joyous crowd.

—MACAULAY'S *Lays of Ancient Rome.*

FALL OF THE ROMAN EMPIRE.

ALARIC the Goth, Attila the Hun, and Genseric the Vandal, were the great leaders of the barbarians who overthrew Rome.

Starting from Thrace in 396, Alaric, a Visigoth of noble race and Christian faith, overran all Greece. The Vandal Stilicho, the chief of the Roman generals in the West, was sent to oppose him; but the wily Goth escaped into Epirus, where he was hoisted on a shield by his soldiers, according to their national mode of electing a king. There, too, he received from Arcadius the title, Master-General of Eastern Illyricum. His next move (A.D. 403) was upon Northern Italy. Honorius fled from Milan to Asta, and would have been captured there, but for the rapid advance of Stilicho. The Goths, beaten at Pollentia and Verona, left Italy for a time. But, five years later, they marched unopposed to the very walls of

Rome. Stilicho, the only match for Alaric, had just been murdered by his senseless master. Famine and plague raged within the city, until the Gothic king, agreeing to accept a ransom, retired to Tuscany, loaded with all the gold, silver, silk, scarlet cloth, and pepper, that could be gathered in Rome. Honorius, secure in Ravenna, refused to save Rome by any concessions; and the Goths, seizing Ostia at the Tiber's mouth, again summoned the capital to surrender. This second siege was averted by the citizens agreeing to receive, as a new emperor, Attalus, the prefect of the city, who was nominated by Alaric. But this puppet ruler was soon degraded by the same strong hand that had set him up. Then, a band of Goths being cut to pieces near Ravenna, the long-blackening storm at length burst over Rome. In the dead of night (A.D. 410) hostile trumpets blew for the first time in her sleeping streets; and after six days of bloodshed and pillage, the clumsy baggage-waggons of Alaric went creaking southward along the Appian way, piled high with the richest spoils of Rome. All Southern Italy was soon subdued; but, before the conquering hordes could pass into Sicily, their leader died at Cozenza, in Calabria. To make his grave a river was turned aside; and when the water was again let flow into its bed over the dead king, the prisoners who had built his tomb were slain, that no one might be able to tell where the conqueror of Rome was laid.

And now the great Western Empire was dissolving fast. Early in the fifth century, three fragments broke off from the decaying trunk, not to die, but to start up with new and fresher life into three great kingdoms. Britain was left to itself. Spain was conquered by Sueves, Alans, and Vandals. Gaul was filled with Goths, Burgundians, and Franks. Adolph, brother-in-law of Alaric, marched under the colours of Honorius, whose sister he had married, to rescue Spain; but he was murdered at Barcelona.

Africa, too, was lost. The Roman general Boniface, revolting from Valentinian III., called Genseric and his Vandals over from Spain. Crossing the strait in Spanish vessels, the barbarian leader reviewed a motley force of 50,000 on the Moorish plains. Vandals, Alans, Goths, were all there. Tawny Moors, who at first had looked on the white faces with fear, gradually joined their ranks; and the Donatists, a religious sect writing under persecution, gladly welcomed a protector in the Arian Genseric. Boniface, repenting of his haste only when it was too late, saw with dismay all the rich wheat-fields, upon which Rome depended mainly for her bread, laid waste from Tangier to Tripoli. In 431, Hippo Regius, a seaport now called Bona, was burnt. Boniface, sailing to Italy, fell in battle with his rival Ætius. Carthage yielded to Genseric in 439; and soon African exiles were seen all through Italy and the East.

Meanwhile, Attila, a genuine Hun, with ugly face and strong, squat frame, had gone forth from his log-house on the plains of Hungary, at the head of half a million savages, to conquer the world. Westward to the Rhine, northward to the Baltic, eastward far beyond the Caspian, the terror of his name spread fast; and ere long we find him in the suburbs of Constantinople, dictating insulting terms of peace to the trembling Theodosius II., (446.) A year or two later, after the Huns had gone home, an embassy was sent over the Danube by the court of Constantinople to visit Attila in his wooden palace. Among them was an assassin, secretly charged to murder the royal Hun; and this was the real business of the embassy. Though the treacherous design was detected, they were entertained with barbaric splendour, and the would-be murderer dismissed with contempt.

In 450 Attila sent to both emperors the haughty message: "Attila commands thee to prepare a palace for his reception." Marcian, Emperor of the East, from whom arrears of tribute were also demanded, replied with spirit, "I have gold for my friends, and steel for my enemies." And so the Hun, preferring to begin with the easier task, fell upon the west. Honoria, a disgraced sister of Valentinian, maddened by her tedious banishment to Constantinople, had before this sent him a ring, praying him to claim her as his wife, and set her free. Seizing this pretext, he demanded in her name half of the Western Empire, which was, of course, refused. Then gathering his Huns around him, he crossed the Rhine, pierced to the centre of Gaul, and began to shake the walls of Orleans with his battering-rams. Terror filled the town, until clouds of dust on the horizon marked the quick advance of a Roman and Gothic army under Ætius and Theodoric. Attila retreated at once to the plain of Chalons; and there was fought one of the decisive battles of the world, resulting in the defeat of the Huns, (A.D. 451.) Thus worsted in Gaul, Attila climbed the Alps into Italy. Aquileia and other cities were laid in heaps, Milan and Pavia were robbed, but left standing; and when the Hun was preparing to march upon Rome, Bishop Leo came with offers from the emperor to give up the required dowry or its value in money. Awe-struck by the majesty of the priest, and remembering, no doubt, that his soldiers were becoming unstrung by the luxury of Italian life, and that the active Ætius was threatening him at every move, he agreed to return to

Hungary, where soon afterwards he broke a blood-vessel. So died one, whose savage boast it was that grass never grew on a spot where his horse had trodden, (453.) His great empire, torn by intestine wars, and pressed on by hordes of Ugri and Avars from Mount Ural, then fell to pieces.

While Attila was threatening Rome on the North, Genseric, who was in alliance with the Hun, had cut down the woods of Mount Atlas, and built a fleet. Sweeping the Mediterranean, he conquered Sicily, made frequent descents upon the Italian coasts, and in 455, at the invitation of Eudoxia, who had been forced to marry Maximus, he cast anchor at the mouth of the Tiber. The purple, still called imperial, though sadly torn and bedraggled, had then been worn by Maximus for about three months. While the Vandals were advancing from Ostia to Rome, Bishop Leo, remembering his influence over Attila, came out to meet them at the head of his clergy. But this could not save the city now, (A.D. 455.) For fourteen days Vandals and Moors wrecked and pillaged without mercy. Exquisite bronzes were melted down; glorious works of sculpture and architecture were wantonly dashed to pieces. Ship-loads of treasure and crowds of captives were carried over the sea to Carthage.

Why should we dwell on the sad story? For sixteen years (456–472), all real power rested with Ricimer, a barbarian soldier, who during that time set up four emperors. There was a gleam of hope when Majorian, first of these, made good laws, and relieved the pressure of the taxes; but it faded in 461, when he died. Then came a time of worse perplexity and terror. In 472, forty days before his death, Ricimer sacked Rome. Three more inglorious names were added to the roll of emperors, that of Romulus Augustulus closing the list. He was a handsome youth, but he was nothing more; and when Odoacer, a Goth of the tribe Heruli, came at the head of the Italian soldiers, threatening him in Ravenna, he yielded ignobly, content to retire to the villa of Lucullus at Misenum, with a pension of 6000 pieces of gold, (A.D. 476.) Then when Odoacer was proclaimed King of Italy, the phantom assembly, which still called itself the Roman senate, sent back to Constantinople the tiara and purple robe, in sign that the Western Empire had passed away.

The division of the empire has been blamed as a great cause of this catastrophe; but truer causes were the oppression of its own unwieldy weight, and the canker of vicious luxury that had long been eating away the strength of its inner life. An empire thus doubly enfeebled, with patched and rotten barriers, could not long withstand the increasing tide of hardy tribes that came pouring, wave upon wave, from the swamps and forests of the north.

—COLLIER.

BOADICEA.

AN ODE.

WHEN the British warrior queen,
Bleeding from the Roman rods,
Sought, with an indignant mien,
Counsel of her country's gods,

Sage beneath the spreading oak
Sat the Druid, hoary chief,
Every burning word he spoke,
Full of rage and full of grief.

"Princess! if our aged eyes
Weep upon thy matchless wrongs,
'Tis because resentment ties
All the terrors of our tongues.

"Rome shall perish—write that word
In the blood that she has spilt;
Perish hopeless and abhorr'd,
Deep in ruin as in guilt.

"Rome, for empire far renown'd,
Tramples on a thousand states;
Soon her pride shall kiss the ground—
Hark! the Gaul is at her gates.

"Other Romans shall arise,
Heedless of a soldier's name;
Sounds, not arms, shall win the prize,
Harmony, the path to fame.

"Then the progeny that springs
From the forests of our land,
Arm'd with thunder, clad with wings,
Shall a wider world command.

"Regions Cæsar never knew,
Thy posterity shall sway;
Where his eagles never flew,
None invincible as they."

Such the bard's prophetic words,
Pregnant with celestial fire,
Bending as he swept the chords
Of his sweet but awful lyre.

She, with all a monarch's pride,
Felt them in her bosom glow,
Rush'd to battle, fought, and died;
Dying, hurl'd them at the foe.

Ruffians, pitiless as proud,
Heaven awards the vengeance due;
Empire is on us bestow'd,
Shame and ruin wait for you.

—Cowper.

THE NORSEMEN IN AMERICA.

The nations inhabiting the borders of the Baltic and the coasts of Norway, as well as those dwelling on the shores of the German Ocean, were situated quite as favourably for maritime enterprise as those upon the banks of the Mediterranean. Though their earliest expeditions by sea were not stimulated by the same cause—the desire for commercial intercourse—they arose from causes equally active. While the Mediterranean countries possessed a fruitful soil and a balmy climate, those of the North, under a sky comparatively ungenial, afforded their inhabitants but a few of the articles which they needed: they were led, therefore, to increase their power by sea, in order to establish themselves in more favoured climes, or, at least, to obtain from them by plunder what their own country could not furnish. Thus they neglected the arts of agriculture, and became inured to a life of piracy upon the sea. They spent their lives in planning and executing maritime expeditions. Fathers gave fleets to their sons, and bade them seek their fortune on the ocean highway. The ships, at first small—being mere barks propelled by twelve oars—came at last to be capable of carrying one hundred or one hundred and twenty men. They were supplied with stones, arrows, ropes with which to overset small vessels, and grappling irons with which to come to close quarters.

It would be remote from our purpose to notice these piratical excursions, were it not that they sometimes resulted in discovery or commerce. Many of the marauders settled permanently in England in the seventh century, and established there the Anglo-Saxon dominion. Alfred, their most celebrated king, obliged to defend his territory from the Danes, turned his attention zealously to everything connected with ships, commerce, discovery, and geography, and became the first founder of that naval power which was at a later period to be the world's dread and admiration. The idea of shipbuilding once conceived, it was prosecuted with astonishing vigour. Alfred not only multiplied their number, but introduced material improvements. Towards the latter part of his reign, his fleet numbered one hundred sail. It was divided into small squadrons, and stationed at various places along the coast.

In the year 863, a Dane of Swedish origin, named Gardar, adventurously pushing off into the Northern Ocean, though upon an object which history has not recorded, discovered the island-rock whose appropriate name is Iceland. Eleven years later, a navigator named Ingolf colonised the country, and the colonists, many of whom belonged to the most esteemed families in the north, established a flourishing republic. The situation of these people, isolated in the midst of an Arctic ocean, and their relation to the mother country, compelled them to exert and develop their hereditary maritime proclivities. In 877, a sailor named Gunribjörn saw a mountainous coast far to the west, supposed to be now concealed or rendered inaccessible by the descent of Arctic ice. Erik the Red, who had been banished from Norway for murder, and had settled in Iceland, was in his turn outlawed thence in 983; he sailed to the west, and discovered a land which he called Greenland, because, as he said, "people will be attracted hither if the land has a good name." He returned to Iceland, and, in the year 985, a large number of ships—according to some authorities, thirty-five—followed him to the new settlement, and established themselves on its south-western shore.

In 986, Bjarni Herjulfson—Bjarni the son of Herjulf—in a voyage from Iceland to Greenland, was driven a long distance from the accustomed track. He at last saw land to the west, and took counsel with his men as to what land it could be. Bjarni declared it his opinion that it was not Greenland. They sailed close in shore, and noticed that there were no mountains, but that the land was undulating and well wooded. They left the land on their larboard side, and sailed away for two days, when they saw land again. They asked Bjarni if he thought this was Greenland, and he replied that "he thought it as little to be Greenland as the other, as he saw no high ice-hills." The sailors wished to wood and water there, but Bjarni would not consent. They sailed for three days to the north, and saw a bold shore with high mountains and ice-hills. Bjarni would not land, saying, "To me this land appears little inviting." Sailing for four days more to the north-east, they came to a country which Bjarni confidently pronounced to be Greenland, where he landed and afterwards settled. Various data furnished by this narrative, in the original Icelandic records, have enabled geographers to determine the various coasts thus dimly seen by Bjarni, but upon which he did not land. They are supposed to have been those of Long Island, Rhode Island, Massachusetts, Nova Scotia, and Newfoundland.

In the year 994, Leif Erikson—Leif the son of Erik the Outlaw—bought Bjarni's ship, and engaged thirty-five men to navigate it, as he intended to sail upon a voyage of discovery. He asked his father Erik to be the captain; but Erik declined, being, as he said, well stricken in years. They sailed away into the sea, and discovered first the land which Bjarni had rejected. They went ashore, saw no grass, but plenty of icebergs, and an abundance of flat stones. From the latter circumstance they named the place *Helluland*, *hellu* signifying a flat stone. There can be no doubt that the spot thus named is the modern Newfoundland. They went on board again, and proceeded on their way. They went ashore a second time, where the land was flat, and covered with wood and white sand. "This," said Leif, "shall be named after its qualities, and called Markland," (woodland.) This is undoubtedly Nova Scotia. They sailed again to the south for two days, and came to an island which lay to the eastward of the mainland. They observed dew upon the grass, and this dew, upon being touched with the finger and raised to the mouth, tasted exceedingly sweet. This appears to have been Nantucket, where honey-dew is known to abound.

They proceeded on through a tract of shoal water, which corresponds with the sound between Nantucket and Cape Cod, and appear to have run across the mouth of Buzzard's Bay, and to have ascended the Pocasset River as far as Mount Hope Bay, which they took for a lake. Here they cast anchor, and, "bringing their skin cots from the ship, proceeded to make booths." They remained during the winter, finding plenty of salmon in the river and lake. "The nature of the country was, as they thought, so good, that cattle would not require house-feeding in winter, for there came no frost, and little did the grass wither there." Their statement that on the shortest day the sun was above the horizon from half-past seven till half-past four, enables geographers to fix the latitude of the place where they were at 41° 43′ 10″, which is very nearly that of Mount Hope Bay.

One evening a man of the party was missing, a German named Tyrker, whom Leif regarded as his foster-father. He determined to seek for him, and for this purpose chose twelve reliable men. Tyrker soon returned and said that he had been a long distance into the interior, and had found vines and grapes. "But is this true, my fosterer?" said Leif. "Surely is it true," he returned; "for I was bred up in a land where there is no want of either vines or grapes." The next morning Leif said to his sailors, "We will now set about two things, in that the one day we gather grapes, and the other cut vines and fell trees, so from thence will be a loading for my ship." The record states that the long-boat was filled with grapes. Leif gave the country the name of Vinland, from its vines.

To the reader of the present day it may seem that the wild vines of Massachusetts and Rhode Island can hardly have been so prominent a feature of the native products as to have given a name to the whole region. But it is certain that six centuries later the Puritans found wild maize and grapes growing there in profusion, while the neighbouring island of Martha's Vineyard received its name from the English for a precisely similar reason.

Upon the return of Leif to Greenland, his brother Thorwald thought that "these new lands had been much too little explored." Leif gave him his ship, and he put out to sea, with thirty men, in the year 1002. Nothing is known of their voyage till they came to Leif's booths in Vinland. They laid up their ship, caught fish for their support, and spent a pleasant winter. They passed two years in exploring the interior, and then returned by the north, where Thorwald was killed in a battle with the Esquimaux.

But a more successful discoverer than any of these was Thorfinn Karlsnefine; that is, Thorfinn the Predestined Hero. He was a wealthy merchant of Iceland, the heir of Danish, Swedish, and Norwegian princes. He visited Greenland in 1006, where he married Gudrida, the widow of an Icelandic adventurer, and in

1007 sailed, in three ships, and with one hundred and sixty men, upon a voyage to Vinland. His wife went with him, and, in the autumn of the same year, bore him a son named Snorri, who was, of course, the first of European blood born in America. Thorfinn remained here three years, and had many communications with the aborigines. A singular result of this relation may perhaps be traced in the names successively given to one spot. The Northmen called one of their settlements Hóp, and the Puritans, six centuries later, found that the Indians called it Haup. It would appear that they had continued, in their own tongue, the appellation bestowed upon the place in the Norse language. The Puritans anglicised it, and called it Mount Hope.

We have no accounts of any further voyages made by Northmen to America. The records were preserved in the literature of the island, but the memory of them gradually faded away from the popular mind.

Several writers claim for these early navigators a degree of merit beyond that which they are willing to accord to Columbus. "How different," they say, "were the circumstances under which the two voyages were made! The Northmen, without compass or quadrant, without any of the advantages of science, geographical knowledge, personal experience, or previous discoveries; without the support of either kings or governments—which Columbus, however discouraged at the outset, eventually obtained—but guided by the stars, and upheld by their own private resources, and a spirit of adventure which no dangers could repress, crossed the broad northern ocean, and explored these distant lands."

This is all true; and doubtless our wonder at the success with which these early voyages were prosecuted would be augmented tenfold, could we obtain authentic information upon the character and capacity of the ships in which they were made. Nothing reliable exists upon this subject, except a few rude inscriptions; and from these it would actually appear that the vessels used had no decks, and that they were partly propelled by oars. However navigation may have improved since the days of the Northmen, it is certain that no sailor would now attempt an arctic voyage in an open boat; and when we read of the perils and sufferings of our modern Polar adventurers, it is impossible not to be amazed at the success with which the Danes and Norwegians, with their slender appliances, endured and outlived them.

—GOODRICH'S *The Sea.*

THE ORIGIN OF THE ENGLISH NATION.

THE great-grandsons of those who had fought under William, and the great-grandsons of those who had fought under Harold, began to draw near to each other in friendship; and the first pledge of their reconciliation was the Great Charter, won by their united exertions, and framed for their common benefit. Here commences the history of the English nation. The history of the preceding events is the history of wrongs inflicted and sustained by various tribes, which, indeed, all dwelt on English ground, but which regarded each other with aversion such as has scarcely ever existed between communities separated by physical barriers. For even the mutual animosity of countries at war with each other is languid when compared with the animosity of nations which, morally separated, are yet locally intermingled. In no country has the enmity of race been carried further than in England. In no country has that enmity been more completely effaced. The stages of the process by which the hostile elements were melted down into one homogeneous mass are not accurately known to us. But it is certain that, when John became king, the distinction between Saxons and Normans was strongly marked, and that before the end of the reign of his grandson it had almost disappeared. In the time of Richard I., the ordinary imprecation of a Norman gentleman was, "May I become an Englishman!" His ordinary form of indignant denial was, "Do you take me for an Englishman?" The descendent of such a gentleman a hundred years later was proud of the English name. The sources of the noblest rivers which spread fertility over continents, and bear richly laden fleets to the sea, are to be sought in wild and barren mountain tracts, incorrectly laid down in maps, and rarely explored by travellers. To such a tract the history of our country during the thirteenth century may not inaptly be compared. Sterile and obscure as is that portion of our annals, it is there that we must seek for the origin of our freedom, our prosperity, and our glory. Then it was that the great English people was formed; that the national character began to exhibit those peculiarities which it has ever since retained; and that our fathers became emphatically islanders,—islanders not merely in geographical position, but in their politics, their feelings, and their manners. Then first appeared with distinctness that constitution which has ever since, through all changes, preserved its identity; that constitution of which all the other free constitutions in the world are copies, and which, in spite of some defects, deserves to be regarded as the best under which any great society has ever yet existed during many ages. Then it was that the House of Commons, the archetype of all the representative assemblies which now meet either in the Old or in the New World, held its first sittings. Then it was that the common law rose to the dignity of a science, and rapidly became a not unworthy rival of the imperial jurisprudence. Then it was that the courage of those sailors who manned the rude barks of the Cinque Ports first made the flag of England terrible on the seas. Then it was that the most ancient colleges which still exist at both the great national seats of learning were founded. Then was formed that language, less musical, indeed, than the languages of the south, but in force, in richness, in aptitude for all the highest purposes of the poet, the philosopher, and the orator, inferior to the tongue of Greece alone. Then, too, appeared the first dawn of that noble literature, the most splendid and the most durable of the many glories of England.

—MACAULAY.

THE BATTLE OF AGINCOURT.

THE two armies presented a strange contrast. On the side of the French were three enormous squadrons, three forests of lances, who formed in the narrow plain, and drew up as they successively emerged from the defiles in their rear. In front were the Constables, the Princes, the Dukes of Orleans, Bar, and Alençon, the Counts of Nevers, D'Eu, Richemont, and Vendome, amidst a crowd of barons, dazzling in gold and steel, with their banners floating in the air, their horses covered with scales of armour. The French had archers also, but composed of the commons only; the haughty seigneurs would not give them a place in their proud array. Every place was fixed; no one would surrender his own; the plebeians would have been a stain on that noble assembly. They had cannons also, but made no use of them: probably no one would surrender his place to them.

The English army was less brilliant in appearance. The archers, 10,000 in number, had no armour, often no shoes; they were rudely equipped with boiled skins, tied with osier wands, and strengthened by a bar of iron on their feet. Their hatchets and axes, suspended from their girdles, gave them the appearance of carpenters. They all drew the bow with the *left* arm—those of France with the right. Many of these sturdy workmen had stripped to the shirt, to be the more at ease; first, in drawing the bow, and at last in wielding the hatchet, when they issued from their hedge of stakes to hew away at those immovable masses of horses.

It is an extraordinary, but well-authenticated fact, that the French army was so closely wedged together, and great part so stuck in the mud, that they could neither charge nor retreat; but just stood still to be cut to pieces. At the decisive moment, when the old Thomas of Erpingham arranged the English army, he threw his staff in the air, exclaiming, "Now strike!" The shout of ten thousand voices was raised at once; but to their great surprise, the French army stood still. Men and horses seemed alike enchained or dead in their armour. In truth, these weighty war-horses, oppressed with the load of their armour and riders, were unable to move. The French were thirty-two deep—the English only four. That enormous depth rendered the great bulk of the French army wholly useless. The front ranks alone combated, and they were all killed. The remainder, unable either to advance or retreat, served only as a vast target to the unerring English arrows, which never ceased to rain down on the deep array. On the other hand, every Englishman wielded either his lance, his bow, or his hatchet, with effect. So thick was the storm of arrows which issued from the English stakes, that the French horsemen bent their heads to their saddlebows, to avoid being pierced through their visors. Twelve hundred horse, impatient of the discharge, broke from the flanks and charged. Hardly a tenth part reached the stakes, where they were pierced through, and soon fell beneath the English axes. Then those terrible archers issued from their palisade, and hewed to pieces the confused mass of wounded horses, dismounted men, and furious steeds, which, galled by the incessant discharge of arrows, was now turmoiling in the bloody mud in which the chivalry of France was engulphed. MICHELET, (*Alison's Essays.*)

FALL OF CONSTANTINOPLE.

THE noblest of the Greeks, and the bravest of the allies, were sum moned to the palace, to prepare them, on the evening of the 28th, for the duties and dangers of the general assault. The last speech of Palæologus was the funeral oration of the Roman empire: he promised, he conjured, and he vainly attempted to infuse the hope which was extinguished in his own mind. In this world all was comfortless and gloomy; and neither the Gospel nor the Church have proposed any conspicuous recompense to the heroes who fall in the service of their country. But the example of their prince, and the confinement of a siege, had armed these warriors with the courage of despair; and the pathetic scene is described by the feelings of the historian Pharanza, who was himself present at this mournful assembly. They wept, they embraced; regardless of their families and fortunes, they devoted their lives; and each commander, departing to his station, maintained all night a vigilant and anxious watch on the rampart. The emperor, and some faithful companions, entered the dome of St Sophia, which in a few hours was to be converted into a mosque, and devoutly received, with tears and prayers, the sacrament of the holy communion. He reposed some moments in the palace, which resounded with cries and lamentations; solicited the pardon of all whom he might have injured; and mounted on horseback to visit the guards, and explore the motions of the enemy. The distress and fall of the last Constantine are more glorious than the long prosperity of the Byzantine Cæsars.

In the confusion of darkness, an assailant may sometimes succeed; but in this great and general attack, the military judgment and astrological knowledge of Mahomet advised him to expect the morning, the memorable 29th of May, in the fourteen hundred and fifty-third year of the Christian era. The preceding night had been strenuously employed: the troops, the cannon, and the fascines were advanced to the edge of the ditch, which in many parts presented a smooth and level passage to the breach; and his fourscore galleys almost touched with the prows and their scaling ladders the less defensible walls of the harbour. Under pain of death, silence was enjoined; but the physical laws of motion and sound are not obedient to discipline or fear; each individual might suppress his voice, and measure his footsteps; but the march and labour of thousands must inevitably produce a strange confusion of dissonant clamours, which reached the ears of the watchmen of the towers. At daybreak, without the customary signal of the morning gun, the Turks assaulted the city by sea and land; and the similitude of a turned or twisted thread has been applied to the closeness and continuity of their line of attack. The foremost ranks consisted of the refuse of the host, a voluntary crowd, who fought without order or command; of the feebleness of age or childhood, of peasants and vagrants, and of all who had joined the camp in the blind hope of plunder and martyrdom. The common impulse drove them onwards to the wall; the most audacious to climb were instantly precipitated; and not a dart, not a bullet of the Christians, was idly wasted on the accumulated throng. But their strength and ammunition were exhausted in this laborious defence; the ditch was filled with the bodies of the slain; they supported the footsteps of their companions; and of this devoted vanguard, the death was more serviceable than the life. Under their respective bashaws and sanjaks, the troops of Anatolia and Romania were successively led to the charge: their progress was various and doubtful; but after a conflict of two hours, the Greeks still maintained and improved their advantage; and the voice of the emperor was heard, encouraging his soldiers to achieve, by a last effort, the deliverance of their country. In that fatal moment, the janizaries arose, fresh, vigourous, and invincible. The sultan himself on horseback, with an iron mace in his hand, was the spectator and judge of their valour; he was surrounded by ten thousand of his domestic troops, whom he reserved for the decisive occasions; and the tide of battle was directed and impelled by his voice and eye. His numerous ministers of justice were posted behind the line, to urge, to restrain, to punish; and if danger was in the front, shame and inevitable death were in the rear of the fugitives. The cries of fear and of pain were drowned in the martial music of drums, trumpets, and attaballs; and experience has proved that the mechanical operation of sounds, by quickening the circulation of the blood and spirits, will act on the human machine more forcibly than the eloquence of reason and honour. From the lines, the galleys, and the bridge, the Ottoman artillery thundered on all sides; and the camp and city, the Greeks and the Turks, were involved in a cloud of smoke, which could only be dispelled by the final deliverance or destruction of the Roman Empire. The single combats of the heroes of history or fable amuse our fancy and engage our affections; the skilful evolutions of war may inform the mind and improve a necessary, though a pernicious, science; but in the uniform and odious pictures of a general assault, all is blood, and horror, and confusion; nor shall I strive, at the distance of three centuries and a thousand miles, to delineate a scene of which there could be no spectators, and of which the actors themselves were incapable of forming any just or adequate idea.

The immediate loss of Constantinople may be ascribed to the bullet, or arrow, which pierced the gauntlet of John Justiniani. The sight of his blood, and the exquisite pain, appalled the courage of the chief, whose arms and counsels were the firmest rampart of the city. As he withdrew from his station in quest of a surgeon, his flight was perceived and stopped by the indefatigable emperor. "Your wound," exclaimed Palæologus, "is slight; the danger is pressing; your presence is necessary; and whither will you retire?" "I will retire," said the trembling Genoese, "by the same road which God has opened to the Turks;" and at these words he hastily passed through one of the breaches of the inner wall. By this pusillanimous act he stained the honours of a military life; and the few days which he survived in Galata, or the isle of Chios, were embittered by his own and the public reproach. His example was imitated by the greatest part of the Latin auxiliaries, and the defence began to slacken when the attack was pressed with redoubled vigour. The numbers of the Ottomans was fifty, perhaps a hundred, times superior to that of the Christians; the double walls were reduced by the cannon to a heap of ruins; in a circuit of several miles, some places must be found more easy of access, or more feebly guarded; and if the besiegers could penetrate in a single point, the whole city is irrecoverably lost. The first who deserved the Sultan's reward was Hassan the janizary, of gigantic stature and strength. With his scimitar in one hand, and his buckler in the other, he ascended the outward fortification; of the thirty janizaries, who were emulous of his valour, eighteen perished in the bold adventure. Hassan and his twelve companions had reached the summit; the giant was precipitated from the rampart; he rose on one knee, and was again oppressed by a shower of darts and stones. But his success had proved that the achievement was possible; the walls and towers were instantly covered with a swarm of Turks; and the Greeks, now driven from the vantage-ground, were overwhelmed by increasing multitudes. Amidst these multitudes, the emperor, who accomplished all the duties of a general and a soldier, was long seen, and finally lost. The nobles, who fought round his person, sustained till their last breath the honourable names of Palæologus and Cantacuzene; his mournful exclamation was heard: "Cannot there be found a Christian to cut off my head?" and his last fear was that of falling alive into the hands of the infidels. The prudent despair of Constantine cast away the purple; amidst the tumult he fell by an unknown hand, and his body was buried under a mountain of the slain. After his death, resistance and order were no more; the Greeks fled towards the city, and many were pressed and stifled in the narrow pass of the gate of St Romanus. The victorious Turks rushed through the breaches of the inner wall, and as they advanced into the streets they were soon joined by their brethren, who had forced the gate Phenar on the side of the harbour. In the first heat of their pursuit, about two thousand Christians were put to the sword; but avarice soon prevailed over cruelty, and the victors acknowledged that they should immediately have given quarter, if the valour of the emperor and his chosen bands had not prepared them for a similar opposition in every part of the capital. It was thus, after a siege of fifty-three days, that Constantinople was irretrievably subdued by the arms of Mahomet II. Her empire only had been subverted by the Latins; her religion was trampled in the dust by the Moslem conquerors.

—GIBBON.

SONG OF THE GREEK BARD.

THE isles of Greece, the isles of Greece!
   Where burning Sappho loved and sung,
Where grew the arts of war and peace,
   Where Delos rose, and Phœbus sprung!
Eternal summer gilds them yet,
But all, except their sun, is set.

The Scian and the Teian muse,
   The hero's harp, the lover's lute,
Have found the fame your shores refuse;
   Their place of birth alone is mute
To sounds which echo farther west
Than your sires' "Islands of the Blest."

The mountains look on Marathon—
   And Marathon looks on the sea;
And, musing there an hour alone,
   I dream'd that Greece might still be free;
For, standing on the Persians' grave,
I could not deem myself a slave.

A king sat on the rocky brow
   Which looks o'er sea-born Salamis;
And ships, by thousands, lay below,
   And men in nations; all were his!

He counted them at break of day—
And when the sun set where were they?

And where are they? and where art thou,
My country?—On thy voiceless shore
The heroic lay is tuneless now—
The heroic bosom beats no more!
And must thy lyre, so long divine,
Degenerate into hands like mine!

'Tis something in the dearth of fame,
Though link'd among a fetter'd race,
To feel at least a patriot's shame,
Even as I sing, suffuse my face;
For what is left the poet here?
For Greeks a blush—for Greece a tear.

Must *we* but weep o'er days more blest?
Must *we* but blush?—Our fathers bled.
Earth! render back from out thy breast
A remnant of our Spartan dead!
Of the Three Hundred grant but three,
To make a new Thermopylæ!

What, silent still? and silent all?
Ah! no; the voices of the dead
Sound like a distant torrent's fall,
And answer, "Let one living head,
But one arise—we come, we come!"
'Tis but the living who are dumb.

In vain—in vain: strike other chords;
Fill high the cup with Samian wine!
Leave battles to the Turkish hordes,
And shed the blood of Scio's vine!
Hark! rising to the ignoble call—
How answers each bold bacchanal!

You have the Pyrrhic dance as yet;
Where is the Pyrrhic phalanx gone?
Of two such lessons, why forget
The nobler and the manlier one?
You have the letters Cadmus gave—
Think ye he meant them for a slave?

Fill high the bowl with Samian wine!
  We will not think of themes like these!
It made Anacreon's song divine:
  He served—but served Polycrates—
A tyrant; but our masters then
Were still, at least, our countrymen.

The tyrant of the Chersonese
  Was freedom's best and bravest friend;
That tyrant was Miltiades!
  O! that the present hour would lend
Another despot of the kind!
Such chains as his were sure to bind.

Fill high the bowl with Samian wine!
  On Suli's rock, and Parga's shore,
Exists the remnant of a line
  Such as the Doric mothers bore;
And there, perhaps, some seed is sown,
The Heracleidan blood might own.

Trust not for freedom to the Franks—
  They have a king who buys and sells:
In native swords, and native ranks,
  The only hope of courage dwells:
But Turkish force, and Latin fraud,
Would break your shield, however broad.

Fill high the bowl with Samian wine!
  Our virgins dance beneath the shade—
I see their glorious black eyes shine;
  But gazing on each glowing maid,
My own the burning tear-drop laves,
To think such breasts must suckle slaves.

Place me on Sunium's marbled steep,—
  Where nothing save the waves and I,
May hear our mutual murmurs sweep;
  There, swan-like, let me sing and die:
A land of slaves shall ne'er be mine—
Dash down yon cup of Samian wine!

—Byron.

DISCOVERY OF AMERICA.

Next morning, being Friday, the 3d day of August, in the year 1492, Columbus set sail, a little before sunrise, in presence of a vast crowd of spectators, who sent up their supplications to Heaven for the prosperous issue of the voyage, which they wished rather than expected. Columbus steered directly for the Canary Islands, and arrived there without any occurrence that would have deserved notice on any other occasion. But in a voyage of such expectation and importance, every circumstance was the object of attention.

As they proceeded, the indications of approaching land seemed to be more certain, and excited hope in proportion. The birds began to appear in flocks, making towards the south-west. Columbus, in imitation of the Portuguese navigators, who had been guided in several of their discoveries by the motion of birds, altered his course from due west towards that quarter whither they pointed their flight. But, after holding on for several days in this new direction without any better success than formerly, having seen no object during thirty days but the sea and the sky, the hopes of his companions subsided faster than they had risen; their fears revived with additional force; impatience, rage, and despair appeared in every countenance. All sense of subordination was lost. The officers, who had hitherto concurred with Columbus in opinion, and supported his authority, now took part with the private men; they assembled tumultuously on the deck, expostulated with their commander, mingled threats with their expostulations, and required him instantly to tack about, and return to Europe. Columbus perceived that it would be of no avail to have recourse to any of his former arts, which, having been tried so often, had lost their effect; and that it was impossible to rekindle any zeal for the success of the expedition among men in whose breasts fear had extinguished every generous sentiment. He saw that it was no less vain to think of employing either gentle or severe measures to quell a mutiny so general and so violent. It was necessary, on all these accounts, to soothe passions which he could no longer command, and to give way to a torrent too impetuous to be checked. He promised solemnly to his men that he would comply with their request, provided they would accompany him and obey his command for three days longer; and if, during that time, land were not discovered, he would then abandon the enterprise and direct his course toward Spain.

Enraged as the sailors were, and impatient to turn their faces again towards their native country, this proposition did not appear to them unreasonable; nor did Columbus hazard much in confining himself to a term so short. The presages of discovering land were now so numerous and promising that he deemed them infallible. For some days the sounding-line reached the bottom, and the soil which it brought up indicated land to be at no great distance. The flocks of birds increased, and were composed not only of seafowl, but of such land-birds as could not be supposed to fly far from the shore. The crew of the *Pinta* observed a cane floating, which seemed to have been newly cut, and likewise a piece of timber artificially carved. The sailors aboard the *Nigna* took up the branch of a tree with red berries perfectly fresh. The clouds around the setting sun assumed a new appearance; the air was more mild and warm; and during night the wind became unequal and variable. From all these symptoms, Columbus was so confident of being near land, that, on the evening of the 11th of October, after public prayers for success, he ordered the sails to be furled, and the ships to lie to, keeping strict watch lest they should be driven ashore in the night. During this interval of suspense and expectation, no man shut his eyes; all kept on deck, gazing intently towards that quarter where they expected to discover the land, which had so long been the object of their wishes.

About two hours before midnight, Columbus, standing on the forecastle, observed a light at a distance, and privately pointed it out to Pedro Guttierez, a page of the queen's wardrobe. Guttierez perceived it, and calling to Salcedo, comptroller of the fleet, all three saw it in motion, as if it were carried from place to place. A little after midnight, the joyful sound of *Land! Land!* was heard from the *Pinta*, which kept always ahead of the other ships. But having been so often deceived by fallacious appearances, every man was now become slow of belief, and waited in the anguish of uncertainty and impatience for the return of day. As soon as morning dawned, all doubts and fears were dispelled. From every ship an island was seen about two leagues to the north, whose flat and verdant fields, well stored with wood, and watered with many rivulets, presented the aspect of a delightful country. The crew of the *Pinta* instantly began the *Te Deum* as a hymn of thanksgiving to God, and were joined by those of the other ships with tears of joy and transports of congratulation. This office of gratitude to Heaven was followed by an act of justice to their commander. They threw themselves at the feet of Columbus, with feelings of self-condemnation, mingled with reverence. They implored him to pardon their ignorance, incredulity, and insolence, which had created him so much unnecessary disquiet, and had so often obstructed the prosecution of his well-concerted plan; and passing, in the warmth of their admiration, from one extreme to another, they now pronounced the man, whom they had so lately reviled and threatened, to be a person inspired by Heaven with sagacity and fortitude more than human, in order to accomplish a design so far beyond the ideas and conception of all former ages.

As soon as the sun arose, all their boats were manned and armed. They rowed towards the island with their colours displayed, with warlike music, and other martial pomp. As they approached the coast, they saw it covered with a multitude of people, whom the novelty of the spectacle had drawn together, whose attitudes and gestures expressed wonder and astonishment at the strange objects which presented themselves to their view. Columbus was the first European who set foot on the new world which he had discovered. He landed in a rich dress, and with a naked sword in his hand. His men followed, and, kneeling down, they all kissed the ground which they had so long desired to see. They next erected a crucifix, and, prostrating themselves before it, returned thanks to God for conducting their voyage to such a happy issue. They then took solemn possession of the country for the crown of Castile and Leon, with all the formalities which the Portuguese were accustomed to observe in acts of this kind in their new discoveries.

The Spaniards, while thus employed, were surrounded by many of the natives, who gazed in silent admiration upon actions which they could not comprehend, and of which they did not foresee the consequences. The dress of the Spaniards, the whiteness of their skins, their beards, their arms, appeared strange and surprising. The vast machines in which they had traversed the ocean, that seemed to move upon the waters with wings, and uttered a dreadful sound resembling thunder, accompanied with lightning and smoke, struck them with such terror that they began to respect their new guests as a superior order of beings, and concluded that they were children of the sun, who had descended to visit the earth.

The Europeans were hardly less amazed at the scene now before them. Every herb and shrub and tree was different from those which flourished in Europe. The soil seemed to be rich, but bore few marks of cultivation. The climate, even to the Spaniards, felt warm, though extremely delightful. The inhabitants appeared in the simple innocence of nature, entirely naked. Their black hair, long and uncurled, floated upon their shoulders, or was bound in tresses on their heads. They had no beards, and every part of their bodies was perfectly smooth. Their complexion was of a dusky copper colour, their features regular rather than disagreeable, their aspect gentle and timid. Though not tall, they were well shaped and active. Their faces and several parts of their bodies were fantastically painted with glaring colours. They were shy at first through fear, but soon became familiar with the Spaniards, and with transports of joy received from them hawk-bells, glass-beads, or other baubles; in return for which they gave such provisions as they had, and some cotton-yarn, the only commodity of value which they could produce. Towards evening, Columbus returned to his ship, accompanied by many of the islanders in their boats, which they called canoes, and though rudely formed out of the trunk of a single tree, they rowed them with surprising dexterity. Thus in the first interview between the inhabitants of the old and new worlds, everything was conducted amicably and to their mutual satisfaction. The former, enlightened and ambitious, formed already vast ideas with respect to the advantages which they might derive from the regions that began to open to their view. The latter, simple and undiscerning, had no foresight of the calamities and desolations which were approaching their country!

—ROBERTSON.

EDINBURGH AFTER FLODDEN.

NEWS of battle! news of battle!
Hark! 'tis ringing down the street;
And the archways and the pavement
Bear the clang of hurrying feet.
News of battle! who hath brought it?
News of triumph? Who should bring
Tidings from our noble army,
Greetings from our gallant king?

All last night we watched the beacons
Blazing on the hills afar,
Each one bearing, as it kindled,
Message of the open'd war.
All night long the northern streamers
Shot across the trembling sky;
Fearful lights, that never beacon,
Save when kings or heroes die.

News of battle! who hath brought it?
All are thronging to the gate;
"Warder—warder! open quickly!
Man—is this a time to wait?"
And the heavy gates are open'd:
Then a murmur long and loud;
And a cry of fear and wonder
Bursts from out the bending crowd,

For they see in batter'd harness
  Only one hard-stricken man;
And his weary steed is wounded,
  And his cheek is pale and wan:
Spearless hangs a bloody banner
  In his weak and drooping hand—
What! can that be Randolph Murray,
  Captain of the city band?

Round him crush the people, crying,
  "Tell us all—oh, tell us true!
Where are they who went to battle,
  Randolph Murray, sworn to you?
Where are they, our brothers—children?
  Have they met the English foe?
Why art thou alone, unfollow'd?
  Is it weal or is it woe?"
Like a corpse the grisly warrior
  Looks out from his helm of steel;
But no word he speaks in answer—
  Only with his armèd heel
Chides his weary steed, and onward
  Up the city streets they ride;
Fathers, sisters, mothers, children,
  Shrieking, praying by his side.
"By the God that made thee, Randolph!
  Tell us what mischance has come."
Then he lifts his riven banner,
  And the asker's voice is dumb.

The elders of the city
  Have met within their hall—
The men whom good King James had charged
  To watch the tower and wall.
"Your hands are weak with age," he said,
  "Your hearts are stout and true;
So bide ye in the Maiden Town,
  While others fight for you.
My trumpet from the border side
  Shall send a blast so clear,
That all who wait within the gate
  That stirring sound may hear.
Or, if it be the will of heaven
  That back I never come,
And if, instead of Scottish shouts,
  Ye hear the English drum,—
Then let the warning bells ring out,
  Then gird you to the fray,
Then man the walls like burghers stout,
  And fight while fight you may.
'Twere better that in fiery flame
  The roof should thunder down,
Than that the foot of foreign foe
  Should trample in the town!"

Then in came Randolph Murray,—
  His step was slow and weak,
And, as he doff'd his dinted helm,
  The tears ran down his cheek:
They fell upon his corslet,
  And on his mailèd hand,
As he gazed around him wistfully,
  Leaning sorely on his brand.
And none who then beheld him
  But straight were smote with fear,
For a bolder and a sterner man
  Had never couch'd a spear.
They knew so sad a messenger
  Some ghastly news must bring,
And all of them were fathers,
  And their sons were with the king.

And up then rose the provost—
  A brave old man was he,
Of ancient name, and knightly fame,
  And chivalrous degree.

. . . .

Oh, woeful now was the old man's look,
  And he spake right heavily—
"Now, Randolph, tell thy tidings,
  However sharp they be!
Woe is written on thy visage,
  Death is looking from thy face:
Speak! though it be of overthrow—
  It cannot be disgrace!"

Right bitter was the agony
  That wrung that soldier proud:
Thrice did he strive to answer,
  And thrice he groan'd aloud.
Then he gave the riven banner
  To the old man's shaking hand,
Saying—"That is all I bring ye
  From the bravest of the land!
Ay! ye may look upon it—
  It was guarded well and long,

By your brothers and your children,
By the valiant and the strong.
One by one they fell around it,
As the archers laid them low,
Grimly dying, still unconquer'd,
With their faces to the foe.
Ay! ye may well look upon it—
There is more than honour there,
Else, be sure, I had not brought it
From the field of dark despair.
Never yet was royal banner
Steep'd in such a costly dye;
It hath lain upon a bosom
Where no other shroud shall lie.
Sirs! I charge you, keep it holy,
Keep it as a sacred thing,
For the stain you see upon it
Was the life-blood of your king!"

Woe, woe, and lamentation!
What a piteous cry was there!
Widows, maidens, mothers, children,
Shrieking, sobbing in despair!

. . . .

"Oh the blackest day for Scotland
That she ever knew before!
Oh our king! the good, the noble,
Shall we see him never more?
Woe to us, and woe to Scotland!
Oh our sons, our sons and men!
Surely some have 'scaped the Southron,
Surely some will come again!"
Till the oak that fell last winter
Shall uprear its shatter'd stem—
Wives and mothers of Dunedin—
Ye may look in vain for them!

—Aytoun.

THE BATTLE OF NASEBY.

The battle occurred in the middle of June 1645. Charles was at Harborough when he heard that Fairfax had drawn off from Oxford, and he resolved to advance towards him. The king and all about him were in high spirits, fully believing that the parliament army was in a disorganized state, that the new model which had just been adopted was unsuccessful, and that he had but to appear, and victory would at once of necessity declare for him.

Charles advanced to Daventry, where he waited several days for more correct intelligence of the movements of the enemy. Intelligence came, but of another kind than he expected. Fairfax, he learned, was close at hand; he had reached Northampton with an army more considerable than had been reported to him, and in good condition. This being the case, he resolved to fall back upon Harborough, and from thence proceed as rapidly as he might to Leicester. Meanwhile Fairfax had not been idle; anticipating an engagement, he had written to the Parliament, requesting that Cromwell might be spared from his attendance at the House of Commons, in order to take command of the horse, an engagement being likely to happen speedily. On Friday, (June 13,) a council of war is summoned to determine what it is best to do. While the debate is going forward, a loud noise is heard in the camp. Cromwell is come! and "the horse give a mighty shout for joy of his coming to them." He has brought, too, seven hundred of his own Ironsides with him—good men all—but himself a host. There is little hesitancy now. Onward is the word. An alarm soon reaches Harborough that the Roundheads are at hand—that they are quartered within six miles. No chance of reaching Leicester now: that is plain enough, whatever else is doubtful. "A council was presently called, and the former resolution of retiring presently laid aside, and a new one as quickly taken, 'to fight,' to which there was always an immoderate appetite, when the enemy was within any distance. They would not stay to expect his coming, but would go back to meet him. And so, in the morning early, being Saturday the fourteenth of June, all the army was drawn up, upon a rising ground, of very great advantage, about a mile south from Harborough (which was left at their back), and there put in order to give or receive the charge." But they did not stay there. Fairfax had set out from his quarters by daybreak, and, after a march of an hour or two, sees some of the king's troops on the high grounds before him. Charles had been led to move his troops from their former, and, as it should seem, preferable position, owing to his misconceiving the purport of some movements on the part of his adversary, and now had scarcely time to arrange his army before the enemy made signs of attacking him.

The position which the king's army had now taken is on the north-eastern side of Naseby field; the parliament's army occupies the hill about half a mile on the south. The deep hollow is between them. The order of battle is soon formed. On the king's side, Prince Rupert has the command of the right wing, Sir Marmaduke Langdale of the left, while the main body is commanded by Lord Ashley; the king being with the reserves, and having Lord Lindsay, Sir George Lisle, and others with him. On the opposite side, Cromwell commands the right, and Ireton the left wing; the centre is under the charge of the General (Fairfax) himself, and Major Skippon; Ramsborough, Hammond, and Pride, commanding the reserves. Each party forms a line stretching across the field; the order of each is similar—the infantry being in the centre, with the cavalry as wings. Yonder hill, where the king's troops are, is Broad Moor; they have a warren on their left. This, whereon the parliament's army is ranged, is Mill Hill; that Fenny Hill on the left; a troop of Ireton's dragoons is behind the hedge that divides Naseby and Sulby Honours. Both armies are well placed; it is clear, though, that Cromwell has herein the advantage. He has secured such a position as to screen a considerable part of his men, by means of the broken ground, from the observation of the enemy, while he commands a full view of them, and can detect at once all their movements. In numbers there is little difference between them. In courage they are equal, but not in confidence. That "mighty shout" of the horse yesterday, when "Fairfax's invincible lieutenant" came, was it not a presage to victory? Fairfax himself, too, his looks were pale as death yesterday, but now he is all alacrity; "his soldiers see in his cheerful countenance the promise of victory." On the other side the cavalry is full of assurance, but the infantry is hardly so hopeful. Those marchings and countermarchings, and constant changing of plans, do not speak well for their commanders' decision and clear-sightedness. A mighty difference; it is the hour of life or death, and they cannot confide in their leaders' firmness and foresight, on which both depend! But they are brave men, and will do bravely. The Royalists place bean-stalks in their hats; the others have no directions on the subject; a few of their own accord put up some white paper or linen, the rest carry no mark.

Thus, then, these twenty thousand men stand face to face on that fair summer morning, waiting for the word in order to fall upon each other. The broad moor glows with the broom in full flower, —its golden glory mingling with the lowlier blossoms of the heath. The wind blows sharply from the north-west, and there is a little preparatory manœuvring to obtain the advantage of it. A few shots are fired from the scanty artillery on either side. And see, a forlorn hope of three hundred musketeers advances towards the royal army; its orders are to advance steadily, to wait in the vale until it is charged, and then fall back as steadily as it advanced. The battle is begun. Rupert with his right approaches the left of his opponents. He charges swiftly, terribly, crying "Queen Mary!" while the answering shout is "God is our strength!" Brave is the meeting, Ireton is not made to yield, bravely is that fierce charge encountered, but it is irresistible. Ireton is borne down, his horse is killed, himself thrust through the thigh with a halberd, and wounded in the face; his eyes become dim, he is carried off a prisoner, and his troops fly swiftly, while Rupert's as swiftly pursue them. How fares it on the other wing? Has the Invincible given way? Not he. Langdale charged him, but he yielded not a step. His ironsides charged in turn—like a torrent driving all before them. Down they push into that narrow valley, conquerors and conquered; but his clear eye sees when to stay the pursuit. He drives them fairly from the field, far enough to prevent them rallying, then he as quickly returns to it. Work is yet to do there, and he well knew his work is undone while anything remains to do,—scattered troops may rally, but the danger is from those who stand.

With those in the centre there has been hot work. Ashley comes on with ready energy—there is one discharge on each side, and then closing they meet hand to hand, fighting with the butt-ends of their muskets. For a brief space this continues, then all of the Roundheads, but Fairfax's own regiment, give way. But they rally. The general, bareheaded, (for he lost his helmet in the first charge,) with a "spirit heightened above the ordinary spirit of man," thinks not for a moment of retreat. He is "to and again in the front, carrying orders, bringing on divisions in thickest dangers, and with gallant bravery." Skippon, too, is busy; he brings on a troop that is not quite disorganised, but in doing it is shot in the side, "yet still leads them on." Nor will he quit the field though Fairfax desires him. "No, general, I will not stir," replies the brave old man; "I will not stir while a man will stand." But the disorder is too great to be remedied. Then the commanders with their colours, and such of the soldiers as are firm, fall into the reserves, order is re-established, and these fresh troops advancing, quickly compel the wearied Royalists to fly. Not all! there stands one regiment "like a rock." Again and again Fairfax charges, but they stand rock-like still, though their comrades have all deserted them; and though the king, for whom they are dying, stands with his untouched reserves idly on the hill there. What heed they! They know their duty, and will do it. Grievous is it to see brave men thus stand hopeless. Fairfax despatches Skippon with his regiment to the other side, and so with sharp shots, with heavy blows, they beat their way through that rock and meet in the middle. It is battered down, crushed. But why stand those reserves idly there? Will decision never reach their counsels? The king will charge—is ready to do so—plainly must do so—is not the foot everywhere breaking? He places himself at the head of his guards, but the Earl of Carnewath, who rides next him, "lays his hand on the bridle of the king's horse, and with two or three foul-mouthed Scottish oaths, cries, 'Will you go upon your death in an instant?' and before the king understands what he will have, turns his horse round." Straight flies the word—"the king runs, every one shift for himself," —and without a blow—without advancing towards the field—all of that reserve fly as though the Invincible was indeed upon them.

But where tarries Rupert all this while? Alas! he is a gallant soldier, but not a wise one. He drove far the troops who fled before him—too far, but he returned at last? The foolish boy! he comes upon the train of his adversaries on his return, and must needs stay to take it. He wants trophies—his men want booty, and so they fall on there, while their fellows are being hewed to pieces in the field—clean forgotten! But the train is well guarded—Cromwell is not a careless soldier—and Rupert cannot make an impression upon it. Again he tries, but it is in vain. Again? No—"to the field." It is too late; all is lost there, and he has some difficulty in rejoining the king, who has rallied his reserves about half a mile beyond his old station. Meanwhile Cromwell had returned and completed the work of destruction in the field; then calling off their men, the generals put them again in order, and they advance ready for battle as at first.

Not so with the king's men. "One charge more and we regain the day," pleads he, and pleads in vain. Rupert's men declare they have acted their parts—the battle is over, they will not begin the day again. They have no "cause" to fight for. "That difference was observed shortly from the beginning of the war," as Clarendon tells us, "in the discipline of the king's troops, and of those which marched under the command of Cromwell, that though the king's troops prevailed in the charge, and routed those they charged, they never rallied themselves again in order, nor could be brought to make a second charge again the same day; whereas Cromwell's troops, if they prevailed, or though they were beaten and routed, presently rallied again and stood in good order till they received new orders." In vain, therefore, was it to entreat them to stand when they saw those men before them closing steadily upon them. They retreat slowly at first, but ever quickening till retreat becomes a chase for life or death. It was "extreme" hot work, as one who was in it said, and hot was the chase afterwards. "We pursued them," said Cromwell in his letter written directly after, "from three miles short of Harborough to nine beyond, even to sight of Leicester, whither the king fled." And now, when a peaceful peasant is digging a trench from some of the meadows, or by the road side, it often happens that his spade strikes upon the bones of one of those poor stragglers. From Naseby to Leicester—a weary sixteen miles for those miserable men. What was it to them that the fields were fair, that the trees were bending beneath their graceful foliage, that the gentle sun was sliding softly and in beauty towards the west—they dared not even stoop to drink from the brook murmuring so gently by the way-side, heedless of all that bloody work. Frightful was the encounter, more terrible the flight. —THORNE.

ON THE DOWNFALL OF POLAND.

Oh! sacred Truth! thy triumph ceased awhile,
And Hope, thy sister, ceased with thee to smile,
When leagued Oppression pour'd to Northern wars
Her whisker'd Pandoors, and her fierce hussars,
Waved her dread standard to the breeze of morn,
Peal'd her loud drum, and twang'd her trumpet-horn:
Tumultuous horror brooded o'er her van,
Presaging wrath to Poland—and to man!

Warsaw's last champion from her heights survey'd,
Wide o'er the fields, a waste of ruin laid,—
O Heaven! he cried, my bleeding country save!
Is there no hand on high to shield the brave?
Yet, though Destruction sweep those lovely plains,
Rise, fellow-men! our country yet remains!
By that dread name, we wave the sword on high!
And swear for her to live!—with her to die!

He said, and on the rampart-heights array'd
His trusty warriors, few, but undismay'd;
Firm-paced and slow, a horrid front they form,
Still as the breeze, but dreadful as the storm;
Low murmuring sounds along their banners fly,
Revenge or death,—the watchword and reply;
Then peal'd the notes, omnipotent to charm,
And the loud tocsin toll'd their last alarm!—

In vain, alas! in vain, ye gallant few!
From rank to rank your volley'd thunder flew:—
Oh! bloodiest picture in the book of Time,
Sarmatia fell, unwept, without a crime;
Found not a generous friend, a pitying foe,
Strength in her arms, nor mercy in her woe!
Dropp'd from her nerveless grasp the shatter'd spear,
Closed her bright eye, and curb'd her high career;—
Hope, for a season, bade the world farewell,
And Freedom shrieked—as Kosciusko fell!

The sun went down, nor ceased the carnage there,
Tumultuous murder shook the midnight air—
On Prague's proud arch the fires of Ruin glow,
His blood-dyed waters murmuring far below;

The storm prevails, the rampart yields a way,
Bursts the wild cry of horror and dismay!
Hark! as the smouldering piles with thunder fall,
A thousand shrieks for hopeless mercy call!
Earth shook—red meteors flash'd across the sky,
And conscious nature shudder'd at the cry!

Departed spirits of the mighty dead!
Ye that at Marathon and Leuctra bled!
Friends of the world! restore your swords to man,
Fight in his sacred cause, and lead the van!
Yet for Sarmatia's tears of blood atone,
And make her arm puissant as your own!
Oh! once again to Freedom's cause return
The patriot Tell—the Bruce of Bannockburn!

—CAMPBELL.

BATTLE OF BALACLAVA—CAVALRY CHARGE.

THE cavalry who have been pursuing the Turks on the right are coming up to the ridge beneath us, which conceals our cavalry from view. The heavy brigade in advance is drawn up in two lines. The first line consists of the Scots Greys, and of their old companions in glory the Enniskillens; the second of the 4th Royal Irish, of the 5th Dragoon Guards, and of the 1st Royal Dragoons. The Light Cavalry Brigade is on their left, in two lines also. The silence is oppressive; between the cannon bursts one can hear the champing of bits and the clink of sabres in the valley below. The Russians on their left drew breath for a moment, and then in one grand line dashed at the Highlanders. The ground flies beneath their horses' feet; gathering speed at every stride, they dash on towards that *thin red streak topped with a line of steel.* The Turks fire a volley at eight hundred yards, and run. As the Russians come within six hundred yards, down goes that line of steel in front, and out rings a rolling volley of Minié musketry. The distance is too great; the Russians are not checked, but still sweep onward through the smoke, with the whole force of horse and man, here and there knocked over by the shot of our batteries above. With breathless suspense every one awaits the bursting of the wave upon the line of Gaelic rock; but ere they come within a hundred and fifty yards, another deadly volley flashes from the levelled rifle, and carries death and terror into the Russians. They wheel about, open files right and left, and fly back faster than they came. "Bravo, Highlanders! well done!" shout the excited spectators; but events thicken. The Highlanders and their splendid front are soon forgotten; men scarcely have a moment to think of this fact, that the 93d never altered their formation to receive that tide of horsemen. "No," said Sir Colin Campbell, "I did not think it worth while to form them even four deep!" The ordinary British line, two deep, was quite sufficient to repel the attack of these Muscovite cavaliers. Our eyes were, however, turned in a moment on our own cavalry. We saw Brigadier-General Scarlett ride along in front of his massive squadrons. The Russians—evidently *corps d'élite*—their light blue jackets embroidered with silver lace, were advancing on their left, at an easy gallop, towards the brow of the hill. A forest of lances glistened in their rear, and several squadrons of gray-coated dragoons moved up quickly to support them as they reached the summit. The instant they came in sight, the trumpets of our cavalry gave out the warning blast which told us all that in another moment we should see the shock of battle beneath our very eyes. Lord Raglan, all his staff and escort, and groups of officers, the Zouaves, French generals and officers, and bodies of French infantry on the height, were spectators of the scene, as though they were looking on the stage from the boxes of a theatre. Nearly every one dismounted and sat down, and not a word was said. The Russians advanced down the hill at a slow canter, which they changed to a trot, and at last nearly halted. Their first line was at least double the length of ours—it was three times as deep. Behind them was a similar line, equally strong and compact. They evidently despised their insignificant-looking enemy: but their time was come. The trumpets rang out again through the valley, and the Greys and Enniskilleners went right at the centre of the Russian cavalry. The space between them was only a few hundred yards; it was scarce enough to let the horses "gather way," nor had the men quite space sufficient for the full play of their sword-arms. The Russian line brings forward each wing as our cavalry advance, and threatens to annihilate them as they pass on. Turning a little to their left so as to meet the Russian right, the Greys rush on with a cheer that thrills to every heart—the wild shout of the Enniskilleners rises through the air at the same instant. As lightning flashes through a cloud, the Greys and Enniskilleners pierced through the dark masses of Russians. The shock was but for a moment. There was a clash of steel and a light play of sword-blades in the air, and then the Greys and the redcoats disappear in the midst of the shaken and quivering columns.

In another moment we see them emerging and dashing on with diminished numbers and in broken order against the second line, which is advancing against them as fast as it can, to retrieve the fortune of the charge. It was a terrible moment. "God help them! they are lost!" was the exclamation of more than one man, and the thought of many. With unabated fire, the noble hearts dashed at their enemy. It was a fight of heroes. The first line of Russians—which had been smashed utterly by our charge, and had fled off at one flank and towards the centre—were coming back to swallow up our handful of men. By sheer steel and sheer courage, Enniskillener and Scot were winning their desperate way right through the enemy's squadrons, and already gray horses and redcoats had appeared right at the rear of the second mass, when, with irresistible force, like one bolt from a bow, the 1st Royals, the 4th Dragoon Guards, and the 5th Dragoon Guards rushed at the remnants of the first line of the enemy, went through it as though it were made of pasteboard, and, dashing on the second body of Russians, as they were still disordered by the terrible assault of the Greys and their companions, put them to utter rout.

—W. H. Russell.

CHARGE OF THE LIGHT BRIGADE.

I.

Half a league, half a league,
Half a league onward,
All in the valley of death
Rode the six hundred.
"Forward the Light Brigade!
Charge for the guns," he said;
Into the valley of death
Rode the six hundred.

II.

"Forward the Light Brigade!"
Was there a man dismay'd?
Not tho' the soldier knew
Some one had blunder'd:
Theirs not to make reply,
Theirs not to reason why,
Theirs but to do and die.
Into the valley of death
Rode the six hundred.

III.

Cannon to right of them,
Cannon to left of them,
Cannon in front of them,
Volley'd and thunder'd;
Storm'd at with shot and shell,
Boldly they rode and well,
Into the jaws of death,
Into the mouth of hell
Rode the six hundred.

IV.

Flash'd all their sabres bare,
Flash'd as they turn'd in air,
Sabring the gunners there,
Charging an army, while
All the world wonder'd:
Plunged in the battery-smoke,
Right thro' the line they broke;
Cossack and Russian

Reel'd from the sabre-stroke,
  Shatter'd and sunder'd,
Then they rode back, but not—
  Not the six hundred.

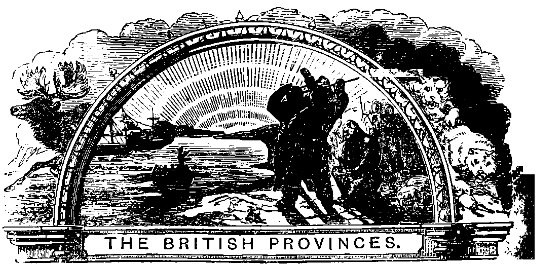
V.

Cannon to right of them,
Cannon to left of them,
Cannon behind them
  Volley'd and thunder'd;
Storm'd at with shot and shell,
While horse and hero fell,
They that had fought so well
Came thro' the jaws of death,
Back from the mouth of hell,
All that was left of them;
  Left of six hundred.

VI.

When can their glory fade?
Oh the wild charge they made!
  All the world wonder'd.
Honour the charge they made!
Honour the Light Brigade,
  Noble six hundred!

—TENNYSON.



DISCOVERY OF NEWFOUNDLAND.

In the spring of the year 1497, a small squadron of ships sailed from Bristol, in search of a passage to India by the north-west. Two men of Venetian origin, John Cabot and his son Sebastian, a youth of twenty years of age, undertook their guidance. After a toilsome voyage of many weeks, they entered a region of vast banks, fogs, and mists, but continued on with unshaken hardihood. About three o'clock on the morning of the 24th of June, they reached a land hitherto unnoted in any map or record; sterile and uncultivated, abounding in great white bears and elks. The discoverers called this country by a name signifying "rich in fish," from the numbers which swarmed in the rivers, and along the sea-coast. The inhabitants were wild and unfriendly, clothed with the skins of beasts, and painted with a reddish clay.

The Cabots returned to England that year, and it does not appear that any further notice was taken of this country, which the English called Newfoundland, till 1534; when the brave Jacques Cartier, with only sixty men, sailed from St Malo in two small vessels, under the French flag, and nearly circumnavigated the island. He found it to be a great triangle, of irregular shape, and about nine hundred miles round, with deep indentures and numerous harbours, but with a soil everywhere unfruitful.

Two Englishmen, named Elliott and Thorn, traded there for some years under the protection of Henry VIII., obtaining rich furs from the natives. At length these unhappy men, with a body of their dependents, made a settlement, and determined to remain there over the winter. They knew not what they had to meet; their provisions failed, none of them survived, and tradition says they ate each other.

The most remarkable among the adventurers who visited these bleak shores, for many years afterwards, was Sir Humphrey Gilbert. He took possession in the name of Queen Elizabeth, but was lost on his return to England: his good brave words in the storm, however, are left us still, "Courage, friends! we are as near heaven here as on the land."

From the beginning of the seventeenth century the French had a settlement at Placentia, on the south coast. In the year 1622, George Calvert landed from England, having with him seeds, grain, and cattle. His settlers were successful, and some of their descendants founded, in a commodious harbour, the capital, St John's.

At the treaty of Utrecht, Louis XIV. of France gave up his claim to the island, which probably he did not care much about, as his subjects retained the right of fishing. It has ever since remained an English colony, and is at present garrisoned by three companies of infantry. The barren soil and ungenial climate defy the skill and industry of the husbandman: wheat does not grow, the scanty crops of barley and oats rarely ripen; from sheltered places near the towns a moderate supply of potatoes and garden vegetables is forced from the unwilling earth. There are a few cattle, the grasses being plentiful and nutritious. All else, for the use of man, comes from over the sea. During the summer, some of the lakes and bays are rich in short-lived beauty. Few have penetrated into the interior for any distance; the hills, as you advance, rise into mountains, the shrubs into trees; there is an idea that the centre of the island is a great valley, filled with numerous lakes and impassable morasses; none of the rivers are navigable far up the country, and there seems but little to tempt the explorer.

The natives met with, in the first discovery, were Esquimaux; fierce men of stalwart frame and intractable disposition; their complexion was a dark red, they were bold hunters and fishers, and of great courage in battle. From the first, they and the white men were deadly foes. The Mic-mac Indians of Nova Scotia, and those red men, carried on a war of extermination against each other for centuries; each landing, with destructive swoop, on the other's coast, scalping the men, and carrying the women into slavery. The Esquimaux warriors were more frequently victorious, till, in an evil hour, they provoked the wrath of the pale faces: the rifle and bayonet soon broke their spirit; abandoning the coasts and the hunting-grounds of their fathers, they fled into the dreary forests of the interior; sometimes, in the long winter nights, they crept out from their wild fastnesses, and visited some lonely hamlet with a terrible vengeance. The settlers in return hunted them down like wolves, and, in the course of years, their life of misery reduced their numbers, and weakened their frames so much, that they never ventured to appear; it was known that some few still lingered, but they were almost forgotten.

The winter of 1830 was unusually severe in this country, and prolonged beyond those of former years. Towards its close, a settler was hewing down trees at some distance from one of the remote villages, when two gaunt figures crept out from the neighbouring "bush:" with sad cries and imploring gestures they tried to express their prayer for help; the white man, terrified by their uncouth and haggard looks, seized his gun, which unhappily lay at hand, and shot the foremost; the other tossed his lean arms wildly into the air—the woods rang with his despairing shrieks as he rushed away. Since then none of the fallen race have been seen. The emaciated frame of the dead man showed how dire had been their necessity. There is no doubt that the last of the red men perished in that bitter winter.

—WARBURTON'S *Hochelaga.*

NOVA SCOTIA.

WHETHER we regard its age, its eventful history, or the tried loyalty of its inhabitants, we may safely say that few of the British colonies are more worthy of our attention than the province of Nova Scotia. It was first discovered to the modern European by the two Cabots, who sailed under a commission from Henry VIII., and landed upon its shores in 1497, a few years after the discovery of America by Columbus, and some time previous to the discovery of the mainland by that navigator. It was totally neglected till 1583, when Sir Humphrey Gilbert perished in attempting to reach its shores. His brother John succeeded in effecting a landing upon the continent the following year; he died, however, shortly afterwards, and his followers returned to England. It is upon these visits that England founded her right to this colony.

The next European, of whom we hear upon these shores, was M. de Monts, a French gentleman, who set sail from Havre in 1604 with a commission from Henry IV., appointing him governor of the northern part of the continent under the name of New France. That portion of it which is represented by the provinces of Nova Scotia and New Brunswick was then called Acadia. De Monts founded a settlement at Port Royal which rapidly progressed, the settlers keeping upon good terms with the aborigines, and being otherwise undisturbed, except on a single occasion when a certain Captain Argall from Virginia made an unprovoked attack upon them.

The successes of the French turned the attention of the English to the Acadian colony, and in 1621, Sir William Alexander, an accomplished gentleman and scholar, obtained from James I. a grant of the whole country. Many Dutch and French adventurers resorted to the province, and an English vessel paid it a visit, but no attempt was made at settlement till the reign of Charles I., who renewed Sir William's charter, and instituted the order of baronets of Nova Scotia, by which name the colony was henceforth to be known. Aided by a French Huguenot named Kirckt, the governor fitted out a few armed vessels which captured some French transports on the way, but did nothing toward permanent settlement. Disgusted with his want of success, Sir William Alexander transferred all but Port Royal to Claude de la Tour, a French Protestant. In 1632, however, the foolish treaty of St Germains ceded Nova Scotia with Canada to France; and a company of merchants, incessantly squabbling among themselves, misgoverned it till 1654, when Oliver Cromwell took possession of the province.

By the treaty of Breda it was again ceded to France. On the fresh outbreak of war, Sir William Phipps set sail from Massachussets, and in 1690 levelled the fortifications of Port Royal, and added Nova Scotia to the government of his province. It remained an appanage of Massachussets till 1696, when the treaty of Ryswick again restored it to France. No sooner had the French re-entered upon the government of the province, than they adopted measures for its colonisation, and largely increased the fur trade and the fisheries. At the same time, they despatched piratical expeditions to the shores of New England, and greatly annoyed the British colonists. The people of New England retaliated in 1704 and 1707; the expedition of the former year under Colonel Church burning and pillaging the country, and that of the latter being ingloriously foiled by the gallantry of M. Subercuse. In 1710, however, a strong force of four war vessels and nineteen transports, containing five regiments, arrived at Port Royal, and, after a brave defence on the part of the besieged, took possession of the country. By the famous treaty of Utrecht in 1715, Nova Scotia was finally ceded to England, and the name of Acadia blotted out from the map.

General Nicholson, who had led the expedition against Port Royal, the name of which was changed to Annapolis in honour of Queen Anne, remained in Nova Scotia as governor till 1719, when Colonel Phillips succeeded him. The proximity of Cape Breton, which still remained in possession of the French, the disloyalty of the Acadians, and the frightful ravages of the Indians, gave considerable anxiety to the early government, especially as few English settlers appeared in the country. The Indians, incited by the French, at last committed such atrocities that large expeditions were undertaken against them. The taking of Louisburg and the Island of St John by the provincial troops under Colonel Pepperel, put a stop to these outrages for a time. France, however, was determined to strike another blow for her lost provinces, and in 1746 despatched a great fleet from Rochelle, under the command of the Duke d'Anville; but before having effected anything, the French fleet was broken up by storms, and its crews and soldiers carried off by disease. Shattered and maimed, a small remnant escaped to France. The defeat of Jonquiere's fleet by Admiral Anson secured the province from further molestation.

A plan of systematic colonization was now entered into with vigour, soldiers and seamen receiving grants of land for their services. Chebucto was fixed upon as the harbour of the province, and soon Governor Cornwallis laid out the town of Halifax, so named in honour of the Earl of Halifax, president of the Board of Trade and Plantations. The French and Indians recommenced their ravages, the latter surprising towns and villages, and scalping the inhabitants, as at Dartmouth and Lunenburg. The disloyalty of the Acadians occasioned so much uneasiness, that it was deemed necessary under the government of Major Lawrence to remove them from the country. They were accordingly called together in the church at Grand Pré and similar places, and transported to the other British American colonies. Many fled to the woods or escaped to the French settlements, their villages being laid waste and their property destroyed. In 1757 a large fleet, commanded by Admiral Holborne, arrived at Halifax from England, with the view of taking possession of Cape Breton and Canada. Owing to various disasters the expedition failed entirely. A short time afterwards, however, a still larger armament under Admiral Boscawen accomplished the reduction of Cape Breton, and not long after the conquest of Canada by Wolfe secured the tranquillity of Nova Scotia. The government, which had hitherto been vested in the Governor and Council, was placed in the hands of a House of Representatives, a constitution was adopted, and the province fairly set upon the high road to prosperity.

By the treaty of Paris in 1763, France relinquished her claims to this province. On the outbreak of the American war, the Nova Scotians proved their firm adherence to the British Crown, and received a large accession to their numbers from the loyal men of the rebellious states. In 1784, Cape Breton was detached from Nova Scotia—with which since its conquest it had been united—and New Brunswick erected into a separate government. In the war of 1812, the marine of Nova Scotia did good service against the Americans, while the operations by land were checked by the humanity of the respective governors of Maine and this province. During the government of Sir James Kempt, Cape Breton was again annexed to Nova Scotia, and has ever since been incorporated with it in government.

FROM "EVANGELINE."

In the Acadian land, on the shores of the Basin of Minas,
Distant, secluded, still, the little village of Grand-Pré
Lay in the fruitful valley. Vast meadows stretch'd to the eastward,
Giving the village its name, and pasture to flocks without number.
Dykes, that the hands of the farmers had raised with labour incessant,
Shut out the turbulent tides; but at stated seasons, the floodgates
Open'd, and welcomed the sea to wander at will o'er the meadows.
West and south there were fields of flax, and orchards, and corn-fields,
Spreading afar and unfenced o'er the plain; and away to the northward
Blomidon rose, and the forests old, and aloft on the mountains
Sea-fogs pitch'd their tents, and mists from the mighty Atlantic
Look'd on the happy valley, but ne'er from their station descended.
There, in the midst of its farms, reposed the Acadian village.
Strongly built were the houses, with frames of oak and of chestnut,
Such as the peasants of Normandy built in the reign of the Henries.
Thatch'd were the roofs with dormer-windows; and gables projecting
Over the basement below protected and shaded the doorway.
There, in the tranquil evenings of summer, when brightly the sunset
Lighted the village street, and gilded the vanes on the chimneys,
Matrons and maidens sat in snow-white caps, and in kirtles
Scarlet, and blue, and green, with distaffs spinning the golden
Flax for the gossiping looms, whose noisy shuttles within doors
Mingled their sound with the whir of the wheels and the songs of the maidens.
Solemnly down the street came the parish priest; and the children
Paused in their play to kiss the hand he extended to bless them.

Revered he walk'd among them; and up rose matrons and maidens,
Hailing his slow approach with words of affectionate welcome.
Then came the labourers home from the field, and serenely the sun sank
Down to his rest, and twilight prevail'd. Anon from the belfry
Softly the Angelus sounded, and over the roofs of the village
Columns of pale blue smoke, like clouds of incense ascending,
Rose from a hundred hearths, the homes of peace and contentment.
Thus dwelt together in love these simple Acadian farmers,—
Dwelt in the love of God and of man. Alike were they free from
Fear, that reigns with the tyrant, and envy, the vice of republics.
Neither locks had they to their doors, nor bars to their windows;
But their dwellings were open as day and the hearts of the owners
There the richest was poor, and the poorest lived in abundance.

. . . .

Still stands the forest primeval; but far away from its shadow,
Side by side, in their nameless graves, the lovers are sleeping.
Under the humble walls of the little Catholic churchyard,
In the heart of the city, they lie, unknown and unnoticed.
Daily the tides of life go ebbing and flowing beside them,
Thousands of throbbing hearts, where theirs are at rest and for ever;
Thousands of aching brains, where theirs no longer are busy;
Thousands of toiling hands, where theirs have ceased from their labours;
Thousands of weary feet, where theirs have completed their journey?

Still stands the forest primeval; but under the shade of its branches
Dwells another race, with other customs and language.
Only along the shore of the mournful and misty Atlantic
Live a few Acadian peasants, whose fathers from exile
Wander'd back to their native land to die in its bosom.
In the fisherman's cot the wheel and the loom are still busy;
Maidens still wear their Norman caps and their kirtles of homespun,
And by the evening fire repeat Evangeline's story,
While from its rocky caverns the deep-voiced neighbouring ocean
Speaks, and in accents disconsolate answers the wail of the forest.

—LONGFELLOW.

NEW BRUNSWICK.

THE history of New Brunswick is embodied with that of Nova Scotia, of which province it formed a part until 1785. The first settlement attempted by the British was in 1762, by a few families from New England, on the river St John, about fifty miles from its mouth, and was named Maugerville.

These people experienced great misery, and met with many obstacles before they established themselves. The difficulties inseparable from settling in the finest wilderness country in the world, are sufficiently formidable and discouraging, but the hostile spirit of the Indians harassed them still more, and the savages were only at last appeased by the payment of large sums for the wild animals which the English colonists had killed.

During the American war, several other families left New England, and planted themselves on the lands adjoining Maugerville. This district became then the seat of the court of law, and obtained the name of Sunbury.

At the peace of 1783, there were about eight hundred inhabitants in this part of the province. They endured many hardships before they procured ample means to subsist on; but it appears, however, that private dissensions and separate interests formed no small share of the evils that prevented their prosperity.

Three thousand persons from Nantucket arrived at the river St John in the spring succeeding the peace with America. Many of these were men who served during the war; twelve hundred more from the same place followed during the autumn of the same year. The sufferings of these settlers were extremely severe. They had previously enjoyed all the comforts which a country, subdued and cultivated by the endurance and industry of their forefathers, afforded, and they had at once to encounter all the horrors of an approaching winter, without houses to shelter them, amid the wilds of New Brunswick. Their sufferings are described, as follows, by a gentleman now residing at Fredericton, in a small pamphlet descriptive of the province:—"The difficulties," he says, "which the first settlers were exposed to, continued for a long time almost insurmountable. On their arrival, they found a few hovels where St John is now built, the adjacent country exhibiting a most desolate aspect, which was peculiarly discouraging to people who had just left their homes in the beautiful and cultivated parts of the United States. Up the river St John, the country appeared better, and a few cultivated spots were found unoccupied by old settlers. At St Ann's, where Fredericton is now built, a few scattered French huts were found; the country all round being a continued wilderness, uninhabited and untrodden, except by the savages and wild animals; and scarcely had these firm friends of their country (American loyalists) begun to construct their cabins, when they were surprised by the rigours of an untried climate; their habitations being enveloped in snow before they were tenantable. The climate at that period, (from what cause has not yet been satisfactorily ascertained,) being far more severe than at present, they were frequently put to the greatest straits for food and clothing to preserve their existence; a few roots were all that tender mothers could at times procure to allay the importunate calls of their children for food. Sir Guy Carleton had ordered their provisions for the first year, at the expense of government; but, as the country was not much cultivated at that time, food could scarcely be procured on any terms. Frequently had these settlers to go from fifty to one hundred miles, with hand-sleds, or toboggans, through wild woods, or on the ice, to procure a precarious supply for their famishing families. The privations and sufferings of these people almost exceed belief. The want of food and clothing in a wild country was not easily dispensed with, or soon remedied. Frequently, in the piercing cold of winter, some of the family had to remain up during the night to keep fire in their huts to prevent the others from freezing. Some very destitute families made use of boards to supply the want of bedding; the father, or some of the older children, remaining up by turns, and warming two suitable pieces of boards, which they applied alternately to the smaller children to keep them warm, with many similar expedients.

"Many of these loyalists were in the prime of life when they came to this country, and most of them had young families. To establish these, they wore out their lives in toil and poverty, and by their unremitting exertions subdued the wilderness, and covered the face of the country with habitations, villages, and towns. I have not noticed these circumstances as if they were peculiar to the settlers of New Brunswick, but to hold up to the descendants of those sufferers the hardships endured by their parents; and to place in a striking point of view, the many comforts they possess by the suffering perseverance and industry of their fathers.

"Under the judicious and paternal care of Governor Carleton, assisted by several of the leading characters, many of the difficulties of settling an infant and distant country were lessened. The condition of the settlers was gradually ameliorated. The governor himself set a pattern, in which he was followed by several of the leading men in the different offices. A variety of grains and roots were cultivated with success, and considerable progress made in clearing the wilderness."

In 1785, a royal charter was granted to New Brunswick as a distinct province, and the administration confided to Governor Carleton. The safety of property, and the personal protection of the inhabitants, secured the improvement of the country; and its settlements, agriculture, and trade, advanced from this time with little interruption: the inhabitants following such pursuits as necessity directed, or those that were most profitable, or at least agreeable to their inclinations. —J. M'Gregor.

PRINCE EDWARD ISLAND.

Prince Edward Island lies in a great bay in the Gulf of St Lawrence, formed by the northern outline of the three districts I have last spoken of, (Nova Scotia, New Brunswick, and Cape Breton.) It is a hundred and forty miles in length, and thirty-four in breadth in the widest part. Northumberland Strait, in some places only nine miles wide, separates it from New Brunswick and Nova Scotia. The area of the island is about two thousand square miles. The features of this country are softer than those of its neighbours; there are no mountains, but gentle and fertile undulations, clothed, to the water's edge, with valuable woods and rich verdure. The north shore is very beautiful; many cheerful villages and green clearings, with small lakes, shady harbours, and numerous streams, diversify its scenery. In the course of ages, the vast flood of the river St Lawrence has worked indentations into every part of the coast: there is not a spot of this district more than seven or eight miles distant from some arm of the sea; many of these afford shelter to large ships, driven by stress of weather under its crescent-shaped shore, while all are deep enough for the small vessels used in the coasting trade.

On the south-east of the island stands Charlottetown, the capital, at the confluence of three rivers, near the end of Hillsborough Bay. This is an excellent and well-defended harbour; the town is, as yet, but small; it contains the public buildings of the island. The neighbourhood yields only to Quebec in beauty among the scenes of British North America. Its shores are soft, and partly cleared; the rivers wind gracefully through forests of varied foliage; life is given to the picture by the cheerful town; grandeur and variety by the blue and lofty mountains of Nova Scotia in the distance.

This island was also discovered by Sebastian Cabot in 1497. The French first used it as a fishing station, and began to colonize it about the beginning of the eighteenth century. The settlers took part vigorously against the English, in their endless wars in those countries. When the conquerors of Louisburg took possession of this island of St John, as it was then called, they found a number of their countrymen's scalps in the French governor's house. At the end of the last century some Scottish emigrants found their way hither, and most of the present inhabitants are their descendants. The late Duke of Kent, when governor of Nova Scotia, paid great attention to this island; since his time it has improved very much, and its name, in honour of him, was changed to Prince Edward Island.

The land is admirably adapted for pastoral and agricultural purposes, but is denied the mineral wealth of the neighbouring districts; ten times the number of people now scattered over its surface would find abundant room and support. There are (in 1845) about eighty schools, and a proportionate number of churches. A governor is appointed by the English crown, and the internal government is the same as in the sister colonies. Two or three newspapers are published in the island, and it is not without its mustard-pot storms of politics. The fisheries of these shores are of great value, but little advantage is taken of this resource. Many ships are built on the island, and sold to the neighbouring colonies, but year by year its increasing trade requires a greater number for its own uses. Prince Edward Island is more favoured in climate than any other part of North America; it has neither the extremes of heat and cold of Canada, nor the fogs of Nova Scotia and Cape Breton; fevers and consumption are almost unknown; the air is dry and bracing; the sickly and weak, under its salubrious influence, soon become healthy and robust; and the age of fivescore years is often reached in vigour of mind and body. This happy country furnishes plenty, but not wealth: the people are hospitable, moral, and contented.

—WARBURTON'S *Hochelaga.*

JACQUES CARTIER.

IN the seaport of St Malo 'twas a smiling morn in May,
When the Commodore Jacques Cartier to the westward sail'd away;
In the crowded old cathedral all the town were on their knees
For the safe return of kinsmen from the undiscover'd seas;
And every autumn blast that swept o'er pinnacle and pier,
Fill'd manly hearts with sorrow, and gentle hearts with fear.

II.

A year pass'd o'er St Malo—again came round the day
When the Commodore Jacques Cartier to the westward sail'd away;
But no tidings from the absent had come the way they went,
And tearful were the vigils that many a maiden spent;
And manly hearts were fill'd with gloom, and gentle hearts with fear,
When no tidings came from Cartier at the closing of the year.

III.

But the Earth is as the Future, it hath its hidden side;
And the Captain of St Malo was rejoicing in his pride

In the forests of the north—while his townsmen mourn'd his loss,
He was rearing on Mount Royal the *fleur-de-lis* and cross;
And when two months were over, and added to the year,
St Malo hail'd him home again, cheer answering to cheer.

IV.

He told them of a region, hard, iron-bound, and cold,
Nor seas of pearl abounded, nor mines of shining gold;
Where the wind from Thulé freezes the word upon the lip,
And the ice in spring comes sailing athwart the early ship;
He told them of the frozen scene until they thrill'd with fear,
And piled fresh fuel on the hearth to make him better cheer.

V.

But when he changed the strain—he told how soon is cast
In early spring the fetters that hold the waters fast;
How the winter causeway broken is drifted out to sea,
And the rills and rivers sing with pride the anthem of the free;
How the magic wand of summer clad the landscape to his eyes,
Like the dry bones of the just, when they wake in Paradise.

VI.

He told them of the Algonquin braves—the hunters of the wild,
Of how the Indian mother in the forest rocks her child;
Of how, poor souls, they fancy in every living thing
A spirit good or evil, that claims their worshipping;
Of how they brought their sick and maim'd for him to breathe upon,
And of the wonders wrought for them through the Gospel of St John.

VII.

He told them of the river whose mighty current gave
Its freshness for a hundred leagues to Ocean's briny wave;
He told them of the glorious scene presented to his sight,
What time he rear'd the cross and crown on Hochelaga's height,
And of the fortress cliff that keeps of Canada the key,
And they welcomed back Jacques Cartier from his perils o'er the sea.

—DARCY M'GEE.

QUEBEC; OR, THE EARLY HISTORY OF CANADA.

Now, while we rest after the long and weary voyage, lend me patience while I tell the old tale of how, and by whom, this fair city came to be built; and why the flag of dear Old England floats upon its citadel.

The first European who ever visited these lands was Jacques Cartier. In the month of May 1535, the year after his circumnavigation of Newfoundland, he again sailed from St Malo with three small ships. He and his followers were blessed by the bishop in the cathedral, received the holy sacrament, and bade farewell to their friends, as if for ever. The little squadron was for a long time dispersed, but met again with great joy on the 26th of July. Having visited Newfoundland, they kept it to the north, and sailed into a large gulf full of islands; they passed on the north side of Anticosti, and, sometimes landing by the way, came at length to the mouth of the Saguenay. By means of two Indians taken in the former voyage, at the Bay of Chaleur, they conversed with the inhabitants, and overcame their terror. These simple people then received them with songs of joy and dances, giving them freely of all the provisions they had. The adventurers soon gathered that there was a town some days' sail higher up; this, and the river, and the countries round about, the natives called Hochelaga; thither they bent their way. The kind-hearted Indians tried, by entreaties and innocent stratagems, to detain their dangerous guests.

During the voyage up the stream they passed shores of great beauty; the climate was genial, the weather warmer than that of France, and everywhere they met with unsuspicious friendship. They found Hochelaga a fortified town among rich corn-fields, on an island under the shade of a mountain, which they called Mount Royal; time has changed it to Montreal. The old name, like the old people, is well-nigh forgotten. The inhabitants had stores of corn and fish laid up with great care, also tobacco, which Europeans saw here for the first time. The natives were courteous and friendly in their manners, some of them of noble beauty; they bowed to a Great Spirit, and knew of a future state. Their king wore a crown, which he transferred to Jacques Cartier; but, when they brought their sick and infirm, trusting to his supernatural power to heal, the Christian soldier only blessed them with the cross, and prayed that Heaven might give them health.

The adventurers returned to France next year, carrying off one of the kings with them, to the great grief of his subjects; he became contented with his lot, but soon after died. This was the first wrong the doomed race suffered from the white men. Four years afterwards, the Sieur de Roberval, graced with many high-sounding titles, and aided by Jacques Cartier, landed at the mouth of the St Charles River; the inhabitants, mindful of former injury, met the strangers with war instead of peace. Seven miles above Quebec is Cap Rouge; there, three hundred years ago, the French built their first stronghold, to guard themselves from just vengeance; they named it Charlesbourg Royal. Their leader, tortured by the dissensions of his followers, soon led them back to France; in 1549, he, with his brave brother, sailed to seek the visionary Cathay, and were heard of no more.

At the end of the sixteenth century, when the gloom of this failure had passed away, Chauvin and Pontgravé opened a fur trade at Tadoussac, without much success. Next followed the Calvinist De Monts, with a little fleet of four sail; his inordinate privileges, and the religious dissensions of his followers, caused his ruin. The worthy Champlain, his successor, founded the city of Quebec in 1608, and cultivated the rich valley of the St Charles; with some of his followers he penetrated to the great lakes of the West, and returned in safety from among their fierce and savage nations. To this vast territory of Canada, he gave the name of New France. For many years the settlers met with great difficulties from the climate and Indians, but adventurers poured in from the old world, and wars and fire-water thinned their foes. Some powerful tribes sought their alliance, serving them to the end with faith and courage. Montreal, Niagara, and other towns were founded, and Quebec was strengthened into the Gibraltar of the West.

The quarrels of the mother countries involved these colonists in constant difficulties with their English neighbours of the south, and their Indian allies added unheard-of horrors to their wars. After many alternate successes, a British army of great force, under the command of General Amherst, invaded Canada in 1759. Ticonderoga fell into his power, and Niagara was won by the division of General Johnson, after a gallant battle. These triumphs were, however, of but little moment, for all knew that on Quebec the fate of Canada depended, and the failure of General Hill, half a century before, had given a lesson of the difficulties of the attack. A large fleet, commanded by Admiral Saunders, carrying an army of seven thousand men, reached the Island of Orleans in the end of June.

For a few years, and for a great purpose, England was given one of those men whose names light up the page of history; he was humble and gentle as a child, graceful in person and manners; raised by transcendent merit in early manhood, he had done high service at Minden and Louisbourg: the purpose was accomplished, and the gift resumed at Quebec, when he was about thirty-two years old. This was WOLFE; to him the expedition was intrusted.

He took possession of the Island of Orleans, and occupied Point Levi with a detachment. His prospects were not encouraging; the great stronghold frowned down on him from an almost inaccessible position, bristling with guns, defended by Montcalm, with a superior force of a gallant army, and inhabited by a hostile population.

Above the city steep banks rendered landing almost impossible; below, the country, for eight miles, was embarrassed by two rivers, many redoubts, and the watchful Indians. A part of the fleet lay above the town, the remainder in the North Channel, between the Island of Orleans and Montmorenci; each tide floated down fire-ships, but the sailors towed them ashore, and they proved harmless.

The plan which first suggested itself was, to attack by the side of Montmorenci, but this the brave Montcalm was prepared to meet. On the 31st of July, a division of grenadiers landed below the falls; some of the boats grounded on a shoal, and caused great confusion, so that arrangements, excellent in themselves, were in their result disastrous. The grenadiers, with an indiscreet ardour, advanced against the intrenchments, unformed and unsupported; a steady and valiant defence drove them back, a storm threatening, and the loss being already heavy, the general re-embarked the troops with quiet regularity. The soldiers drooped under their reverse, but there was always one cheerful face—that of their leader; nevertheless, inward care and labour wasted his weak frame: he wrote to England sadly and despondingly, for the future was very dark; but he acted on an inspiration. His generals were brave men, and suggested daring plans; he seized the boldest counsel, risked the great venture, and won.

On the night of the 12th of September the fleet approached the shore below the town, as if to force a landing. The troops embarked at one in the morning, and ascended the river for three leagues, when they got into boats, and floated noiselessly down the stream, passing the sentries unobserved. Where they landed, a steep narrow path wound up the side of the cliff forming the river's bank; it was defended bravely against them, but in vain. When the sun rose, the army stood upon the plains of Abraham.

Montcalm found he was worsted as a general, but it was still left to him to fight as a soldier; his order of battle was promptly and skilfully made—the regular troops were his left, resting on the bank above the river; the gallant Canadian Seigneurs with their Provincials, supported by two regiments, formed his right: beyond these, menacing the English left, were clouds of French and Indian skirmishers.

General Townshend met these with four regiments; the Louisbourg Grenadiers formed the front of the battle, to the right, resting on the cliff; and there also was Wolfe, exhorting them to be steady, and to reserve their discharge. The French attacked; at forty paces they staggered under the fire, but repaid it well; at length they slowly gave ground. As they fell back, the bayonet and claymore of the Highlanders broke their ranks, and drove them with great carnage into the town.

At the first, Wolfe had been wounded in the wrist; another shot struck him in the body, but he dissembled his suffering, for his duty was not yet done. Again a ball passed through his breast, and he sank. When they raised him from the ground, he tried with his faint hand to clear the death-mist from his eyes; he could not see how the battle went, but the voice which fell upon his dying ear told him he was immortal.

There is a small monument upon the place of his death, with the date, and this inscription:—"Here died Wolfe, victorious." He was too precious to be left, even on the field of his glory. England, jealous of his ashes, laid them with his father's, near the town where he was born. The chivalrous Montcalm was also slain. In a lofty situation on Cape Diamond a pillar is erected "To the memory of two illustrious men, Wolfe and Montcalm."

Five days after the battle, Quebec surrendered, on such terms as generous victors give to gallant foes. The news of these events reached home but forty-eight hours later than the first discouraging despatch, and spread universal joy for the great triumph, and sorrow for its price. Throughout all broad England were illuminations and songs of triumph, except in one country village; for there Wolfe's widowed mother mourned her only child.

This is the story of Quebec nearly a hundred years ago, and the reason why that flag of dear Old England floats above its citadel.

—WARBURTON'S *Hochelaga.*

THE COTEAU RAPID.

THE Coteau—broad, and long, and boisterous!
The waves, like white sea monsters, plunge and roll;
Mighty, and grand, and wildly perilous,
It lives a life of torment. Some mad soul
Seems shouting from each billow, and the howl
Of the lash'd waters, as they foam and writhe,
Is as despair's last shriek, when at the goal,
Where all hope ends, it tumbles headlong with
A cry of anguish to the yawning gulf beneath.

Z

Mad shrieks of horror pierce the seething shore;
Triumphal choruses roll back again;
Up from the depths abysmal, evermore,
Rushes some swift embodiment of pain,
Flying from the fierce conflict all in vain;
A wild, despairing, agonising cry,
A laugh of demons torturing the slain:
Thus the sardonic strife goes crashing by;
The Nameless Terror rolls its burden up the sky.

From isle to isle we wend our devious way;
From crest to crest, from wave to wave we bound;
Baptized anew with showers of snowy spray,
All danger seems in lofty tumult drown'd;
From isle to isle the turmoil rolls profound,—
The true enchantment this—no legend rare,
No wondrous tale by hoar tradition crown'd,
But grand, terrific, true, beyond compare,
The vast sonorous war of passion shakes the air.

And suddenly from the infernal whirl
The ambling current bears us far away,
Where no pursuing wave is seen to curl,
No rapid shatters into blinding spray;
But far behind, the breakers' wild array
Shout from the watery slope their threat'nings dire,
Looming, like Mohawk ghosts at morning gray,
With awful rage and impotent desire,
Striking the wildest chords of Nature's mighty lyre.

—CHARLES SANGSTER; *the St Lawrence and the Saguenay.*

VANCOUVER ISLAND.

ALTHOUGH formerly two distinct colonies, Vancouver Island and British Columbia have now been formed into one united Province, the whole being called "British Columbia." Vancouver Island is the elder. Established in 1849, under the auspices of the Hudson Bay Company, in fulfilment of a condition attached by the Government to the renewal of their charter, the colony had at first but a feeble existence; and, but for the magnetic attraction of the gold-fields on the other side of the Georgia channel, it would have remained in the same undeveloped state, if it had not died out altogether. Viewed from seaward, the island presents rather an unprepossessing appearance. Dark, frowning cliffs girdle its shores; beyond these, with scarcely any interval of level land, rounded hills, densely covered with fir, rise one above the other; and over these, again, appear bare, rugged mountains, with peaks jagged like the end of a saw. The whole centre of the island, as far as it has been explored, is said to be a mass of rock and mountain. Although there is not much open land, it is exceedingly fertile. Victoria, the capital, is situated on undulating ground overlooking the bay. Four years ago it was a mere trading port of the Hudson Bay Company, and contained about 250 people. Its population has now risen to between 3000 and 4000. Broad streets of substantial wooden houses have been erected. A few brick stores, a handsome stone bank, the spires of four churches, one or two Government buildings, and the high, spiked walls of a gaol, distinguish the place from a mere log town, and indicate its pretensions to be regarded as a capital. Suburbs, shaded with oak-trees like an English park, and rich agricultural land, surround the town. Although there is a harbour at Victoria, it is not so good as that at Esquimault, which is beginning to rise into notice. Half a dozen houses, three or four grog-shops, and one or two stores, represent at present the "town" of Esquimault. Vancouver Island is rich in coal, which is of great value in that part of the world, California being deficient in that important mineral. The population of Vancouver Island (which is equal in size to the half of Ireland) is estimated as follows:—5700 whites, (of whom 700 are women,) 500 coloured people, and 15,000 Indians.

—J. H. FYFE.

BRITISH COLUMBIA.

SAILING through the Strait of St Juan de Fuca, on his right the traveller beholds the snow-capped mountains of Washington territory. To the left lies Vancouver Island, low in comparison with the opposite shore, but still possessing heights on which, even in June, patches of snow glisten. The glassy waters of the Gulf of Georgia present a striking appearance, dotted with many little islands, and enlivened by swiftly-gliding canoes filled with painted Indians, slow-paced sailing ships, and spluttering steamers. On the side of the gulf, opposite to Vancouver Island, loom the dark shores of British

Columbia. At first sight the whole country appears to be clothed with forest; but when the traveller moves inland, he learns that, in the lowlands, the pines frequently take the form of belts, enclosing rich valleys and open prairies; lawns, in which oaks and maples, not pines, predominate; marshes, covered with long, coarse grass; and lakes, fringed with flowering shrubs, willows, and poplars. "The impressions which this country leaves on the mind," says Mr Macdonald, C.E., "are of grandeur, gloomy vastness, awful solitude, rendered more dismal by the howl of beasts of prey. Streams, white with foam, flow amid cliffs and ravines, forming at places magnificent waterfalls, whose lonely thunder swells and dies away in the interminable solitude of unpeopled space. Tremendous precipices, yawning gulfs, and towering rocks, whose naked backs have withstood the storms of six thousand years, are all there, to astonish and rivet the attention. Forests of the deepest green present to the eye vast masses of foliage, fresh and glittering in the sunlight; whilst, far above overhanging cliffs and mountains, gleam piles and pyramids of snow and ice, and glacier gorges of remarkable splendour. The surface of the country is generally rocky, except where covered with forest trees and underwood." The deer, the elk, the bear, the puma, and the wolf people the fastnesses of the forest, and there are vast, well-stocked covers of grouse, partridge, and various kinds of wild-fowl. Fish swarm along the shores, and in the numerous lakes which stud the country. The salmon is especially abundant. The Indian, by a few hauls of the net, fills his canoe with them. The bear sits by the side of the river, and paws them out for breakfast, dinner, and supper. The Hudson Bay Company salts annually about two thousand barrels of salmon. There is a great diversity of climate both in British Columbia and Vancouver Island. The white fox and the humming-bird, the reindeer, lichen, and the cactus, may be found within the limits of one territory. Generally speaking, the climate of the sea-coast is milder and finer than that of England, but wet in winter. In the interior the winters are drier and colder, while the summers are hotter.

New Westminster, the capital of British Columbia, stands on the bank of the Fraser River, about fifteen miles from its mouth. It has only 300 inhabitants, but it boasts a church, school, custom-house, jail, barracks, treasury, mint, and assay office. One or two Indian villages in the gold regions are beginning to be transformed into white settlements. With an area about three and a half times as large as Great Britain, British Columbia has a population of 15,000 whites, (of which only a fraction are women,) 2000 Chinamen, and from 10,000 to 15,000 Indians. The aborigines have generally shown themselves friendly; but the outrages which some of the ruffians, attracted by the gold diggings, have perpetrated, have naturally provoked reprisals.

At present, British Columbia is living on its gold-fields. The chief fields are situated in the newly-discovered district of Cariboo, (a corruption from Cerf-bœuf, a large species of reindeer which inhabits the country,) near the sources of Fraser River. This district is described as a

> "Land of brown heath and shaggy wood,
> Land of the mountain and the flood;"

for it is a rugged mass of hills and streams—in the lower parts swampy and heavily timbered with extensive forests, and covered with a dense brushwood in the higher latitudes. The only level ground is found on the tops of the mountains, which are all flat. Ravines abound, along the sides of which run what the miners call "benches," or terraces. These benches, as far as they have been tested, have yielded gold. The only portion of the district that has been explored is a patch of country fifty miles from north to south, and thirty miles from east to west. It bears a striking resemblance to the richest regions of California, and exhibits all the characteristics of an auriferous country. As far as "prospecting" has yet gone, this character has been fully established. The gold is found a few inches, a foot or two, and very seldom more than six feet, below the surface. The gold is all coarse gold—granulated, gravelly stuff, mixed with pellets and pebbles of pure metal of considerable size.

The prizes which some of the miners have made appear marvellous. For instance, in two months five men obtained 100,000 dollars' worth of gold. Allowance must be made, however, for the necessarily high prices of provisions. A meal of beans and bacon, with a cup of wretched coffee, cost two dollars; and half a dollar per square inch was charged for water for sluicing. At the diggings, the cost of living was about sixty dollars a day. Mr Macdonald, therefore, calculates that, regarded as a whole, the mining was a losing game, since the expenditure for food, apparatus, &c., in 1861, exceeded the return of gold by 42,614,836 dollars. If fortunes were gained, fortunes must also have been lost at Cariboo.

Another gold region has lately been discovered to the north of the northern limits of British Columbia, in the Indian land, known as the Stickeen country. This district is of vast extent, and belongs to Great Britain, with the exception of a strip or belt on the Pacific, which was ceded to Russia in 1825. Several hundred miners are now at work along the banks of the Stickeen River.

The chief value of British Columbia lies in the fact that it may one day be traversed by a great highway leading from the Atlantic to the Pacific Ocean. —J. H. FYFE.

THE RED RIVER SETTLEMENT.

IN the very centre of the great continent of North America, far removed from the abodes of civilised men, and about twenty miles to the south of Lake Winnipeg, exists a colony, composed of Indians, Scotchmen, and French Canadians, which is known by the name of Red River Settlement.

Red River differs from most colonies in more respects than one—the chief differences being that, whereas other colonies cluster on the sea-coast, this one lies many hundreds of miles in the interior of the country, and is surrounded by a wilderness; and while other colonies, acting on the golden rule, export their produce in return for goods imported, this of Red River imports a large quantity, and exports nothing, or next to nothing. Not but that it might export if it only had an outlet or a market; but, being eight hundred miles removed from the sea, and five hundred miles from the nearest market, with a series of rivers, lakes, rapids, and cataracts separating from the one, and a wide sweep of treeless prairie dividing from the other, the settlers have long since come to the conclusion that they were born to consume their own produce, and so regulate the extent of their farming operations by the strength of their appetites. Of course, there are many of the necessaries, or, at least, the luxuries of life, which the colonists cannot grow—such as tea, coffee, sugar, coats, trousers, and shirts—and which, consequently, they procure from England by means of the Hudson Bay Fur Company's ships, which sail once a year from Gravesend laden with supplies for the trade carried on with the Indians. The bales containing these articles are conveyed in boats up the rivers, carried past the waterfalls and rapids overland on the shoulders of stalwart *voyageurs*, and finally landed at Red River, after a rough trip of many weeks' duration.*

* Since the above was written, a considerable trade has been carried on between the settlement and the State of Minnesota, through which the Red River mail route runs, and through which all exports from Canada to the

The colony was founded in 1811 by the Earl of Selkirk, previously to which it had been a trading port of the Fur Company. At the time of which we write, it contained about 5000 souls,* and extended upwards of fifty miles along the Red and Assiniboine rivers, which streams supplied the settlers with a variety of excellent fish. The banks were clothed with fine trees; and immediately behind the settlement lay the great prairies, which extend in undulating waves, almost entirely devoid of shrub or tree, to the base of the Rocky Mountains.

Although far removed from the civilised world, and containing within its precincts much that is savage, and very little that is refined, Red River is quite a populous paradise as compared with the desolate, solitary establishments of the Hudson Bay Fur Company. These lonely dwellings of the trader are scattered far and wide over the whole continent—north, south, east, and west. Their population generally amounts to eight or ten men, seldom to thirty. They are planted in the thick of an uninhabited desert, their next neighbours being from two to five hundred miles off, their occasional visitors bands of wandering Indians, and the sole object of their existence being to trade the furry hides of foxes, martens, beavers, badgers, bears, buffaloes, and wolves. It will not, then, be deemed a matter of wonder that the gentlemen who have charge of these establishments, and who, perchance, may have spent ten or twenty years in them, should look upon the colony of Red River as a species of Elysium, a sort of haven of rest, in which they may lay their weary heads and spend the remainder of their days in peaceful felicity, free from the cares of a residence among wild beasts and wild men. Many of the retiring traders prefer casting their lot in Canada; but not a few of them smoke out the remainder of their existence in this colony, especially those who, having left home as boys fifty or sixty years before, cannot reasonably expect to find the friends of their childhood where they left them, and cannot hope to remodel tastes and habits long nurtured in the backwoods, so as to relish the manners and customs of civilised society.

—BALLANTYNE'S *Fur Traders.*

settlement must pass. A steamboat now plies on the Red River between the town of Pembina, in the United States, and the settlement.

* Since increased to 7000.

VICTORIA'S TEARS.

"O MAIDEN, heir of kings,
  A king has left his place;
The majesty of death has swept
  All other from his face.
And thou, upon thy mother's breast,
  No longer lean adown,
But take the glory for the rest,
And rule the land that loves thee best."
    The maiden wept!
She wept to wear a crown.

They decked her courtly halls,
  They rein'd her hundred steeds,
They shouted at her palace gate,
  "A noble queen succeeds!"
Her name has stirr'd the mountain's sleep,
  Her praise has filled the town;
And mourners God had stricken deep,
Look'd hearkening up, and did not weep!
    Alone she wept,
Who wept to wear a crown.

She saw no purple shine,
  For tears had dimm'd her eyes:
She only knew her childhood's flowers
  Were happier pageantries!
And while the heralds play'd their part
  For million shouts to drown,
"God save the Queen," from hill to mart,
She heard, through all her beating heart,
    And turn'd and wept!
She wept to wear a crown!

God save thee, weeping Queen,
  Thou shalt be well beloved,
The tyrant's sceptre cannot move
  As those pure tears have moved.
The nature in thine eye we see,
  Which tyrants cannot own.

The love that guardeth liberties;
Strange blessings on the nation lies,
    Whose sovereign wept,
Yea, wept to wear its crown.

God bless thee, weeping Queen,
  With blessing more divine;
And fill, with better love than earth's,
  That tender heart of thine.
That when the thrones of earth shall be
  As low as graves brought down,
A pierced hand may give to thee
The crown which angels wept to see.
    Thou wilt not weep
To wear that heavenly crown.

—Barrett.

HUDSON BAY TERRITORY.

There is in this western world yet another region of vast size, belonging to the British Crown: it extends from the Labrador coast to the Pacific, four thousand miles from east to west, and from Canada to the North Pole. In its untrodden solitudes, and among the eternal snows of its mountains, lie the mysterious sources of those vast rivers which intersect the plains of the Northern Continent. This dreary tract is called the Hudson Bay Territory. A ridge of mountains runs some degrees to the north of, and parallel to the St Lawrence, as far as the sources of the Ottawa; there it bends away to the north-west, till above Lake Superior, it again inclines to the south, sending out a branch to the unknown regions of the north-west. About three thousand miles from the eastern shores of the continent, these branches meet the great line of the Rocky Mountains, running from north to south. Numbers of large rivers flow from these ranges, some to the Gulf of Mexico, others into the Pacific, some into the great lakes and the St Lawrence, others into Hudson Bay and the frozen oceans of the north. These mountains are nearly five hundred miles in breadth; to the east lies a marshy country where coal abounds; next to this are immense plains or prairies, and still farther east, a desert of rocks and sand, lakes and rivers, stretches away to an unknown distance. On the north, this dreary trackless waste extends to the frozen seas. On the south-west of the "Barren Land" are the Great Bear and Slave Lakes, nearly as large as Lake Huron and Lake Michigan. The southern shores are rich and level, the waters dotted with islands, which are covered with dark woods, and well-stocked with Indian deer. The Lake Athabasca, lying north-west of these, is of great length but very narrow the hardy adventurers who have reached its distant shores, describe them to be of great beauty; two other extensive sheets of fresh water communicate with it. In this neighbourhood, and between it and the great lakes of the St Lawrence, are many fertile plains, fit for the habitations of millions of civilised men.

Again, Lake Winnipeg fills up a portion of the remaining space towards the source of the St Lawrence; its length is two hundred and forty miles; the breadth varies from ten to fifty. A portion of its waters flows into Lake Superior, through the Lake of the Woods; the greater part, however, falls to the north-west by large rivers, but little known leading to Hudson Bay. In all these vast lakes the northern shores are rocky, abrupt, and barren, the southern rich and level, as though the alluvial deposits of some great flood, flowing from the north-west to the south-east for many ages, had poured their riches upon them.

The rivers which flow through this region are but little explored, and but imperfect knowledge is yet obtained of their size and capabilities; several of those falling into Hudson Bay, however, have been traced for more than two thousand miles, but their extreme sources man has not yet reached.

The districts to the north of Oregon are called New Georgia, facing Vancouver Island or Nootka, the more familiar name. Here some mountains rise to a great height, white with eternal snows; but the plains and valleys are fertile, and dotted with rich woods. Clear brooks wander among these undulations, and an exuberant vegetation shows the wealth of the soil and the mildness of the climate; all the trees of Europe flourish here, and grow to an enormous size. Winter spares the western coasts of the American Continent; the soft breezes of the Pacific temper its severity.

For three hundred more miles of seaboard to the north, the country is called New Hanover; its general characteristics are like those of the district last described, but rather more severe. New Cornwall extends thence to the Russian possessions; the climate and the productions show the approach to the Pole, but near the sea the forests are still luxuriant. Many hot springs are here observed among the rocky hills. The numerous islands along the coast are covered with lofty pines, and have a comparatively mild climate up to the straits which separate the Old World from the New. Many mountainous islands, of rare and beautiful rock, form almost a connecting chain between the two promontories of Kamtschatka and Alasca; some of these spout up volcanic fires, others are bound in perpetual ice.

From Behring Strait along to the north-east, are numerous other large and dreary islands, some nearly of the extent of Ireland; but the snow, and rank, poor grasses are their only covering: beyond them is the bound of human enterprise.

The northern shore of Hudson Bay is the land of desolation; lofty mountains of shattered rock, covered with ice, which the sun has never conquered; valleys where the deep drifts of snow have hidden their slopes since the flood. In a few favoured spots, during the brief and fiery summer, some stunted pines and coarse moss show that nature is not dead, but sleeping. Lakes, swamps, and eternal solitudes cover the interior. On the south-western shore are many symptoms of recent volcanic action: there are great seams of coal, iron, and copper. On the south shore, potatoes and other vegetables have been produced, and corn would probably succeed, but has not yet been tried. Farther in the interior, the productions are those of a milder climate than that of Lower Canada. On the coasts of the bay the winter is awful in its severity, and for six months all nature is imprisoned in ice and snow: at some of the settlements of the fur-traders the thermometer in January is often down to fifty degrees below zero, the rivers and lakes are frozen to the bottom, and even in the rooms inhabited by the traders, spirits have been known to freeze into a solid mass. When the withering north wind blows, it is almost beyond the power of man to bear. The particles of ice borne on its frozen breath are driven like poisoned arrows into the flesh, and cover it with sores. Notwithstanding their warm fur clothing and careful habits, the Europeans are often frost-bitten in these awful winters: the wretched natives frequently perish. Rocks are rent by the grasp of the frost, and, with a crash like the roar of artillery, burst into fragments, and are scattered to a great distance round. Often, for many days, the sun is hidden by dense masses of vapour, rising from the sea, and condensed by the cold on the coasts. In the severest times, false suns and moons throw their chill and ghastly glare over the white waste; and, from the inaccessible regions of the Pole, livid flashes illumine the dark skies with a sinister and mysterious light.

For the three months of summer, a more than tropical heat opens this dreary wilderness to the fearless sailors of England; but squalls and currents of terrible violence are to be braved in reaching it. Borne by the tides and winds, huge icebergs glide among these perilous seas, sometimes crushing the largest ships like nut-shells: in one month of one year—April 1825—twenty-five vessels were lost in Melville Bay.

Three distinct native races are condemned to inhabit this dismal country. All are on very friendly terms with the servants of the Hudson Bay Company. They are expert in the chase, and gifted with wonderful endurance: their manners are mild and kind, and they are faithful when any trust is reposed in them; but when the accursed fire-water is within their reach, no tiger is more fierce and bloodthirsty. Very little can be said in favour of their moral character, and they, too, are rapidly diminishing in number. The race sinks lower in the scale of humanity as they spread towards the north and east; there they hunt with the bow and arrow, and fish with nets made of thongs from the skins of beasts; many eat their food raw, others seethe it in birch bark vessels, filled with water heated by hot stones. They are filthy and disgusting in their habits; their horses and other domesticated brutes eat animal food; grass and herbage, even in the summer, being very scanty.

These Indians leave their dead to the carrion birds, and to the wild beasts of the hills. When old age comes on, and they are helpless, their fate is to lie down and perish; neither child nor friend will minister to their wants. In nearly all qualities of mind and body, they are a mean and wretched people. The Esquimaux dwell farther to the north, and from time immemorial have warred against these Indians, who are stronger, and treat them with great barbarity: these are a feeble and timorous race, inhabiting chiefly the islands and peninsulas, where they think themselves more safe from their dangerous neighbours. Of late years the English have made peace between them; but the Esquimaux do not yet dare to venture near the trading factories. In the summer a sloop visits their coast and receives their furs, in exchange for European goods. They are of a low and unsightly figure; their weapons clumsy and inefficient, but much ingenuity is displayed in some of their attempts at ornament. In winter they wander from lake to river, cutting holes in the ice, catching fish and eating it raw: their huts are low and wretched, covered with the skins of deer. Various tribes of these

Esquimaux are scattered through this vast northern region, and along the shores of the Polar Sea. The moose, the reindeer, the buffalo, the bear, and many other animals, are here to be found, with nearly every bird which we have in England. Whales and seals frequent the neighbouring waters in great numbers, with salmon, capelines, and many other dainty fish: in winter they seek some milder climate, and leave the wretched inhabitants to the risk of starvation. Stores are laid in against these times of famine, and some of the coarse herbage assists in the support of life.

The first European that reached these seas was Henry Hudson, sent out in 1610, by the Russia Company, to seek the north-west passage. His crew mutinied, and left him, his son, and some others, to perish on the desolate shores. The same company sent out several other trading expeditions to these countries, and finally, in 1669, received a royal charter, giving them the exclusive privilege of commerce and settlements in the whole of the coasts and districts within Hudson Strait. They retain these rights up to the present day, employing a great quantity of shipping, and a number of adventurous men, who hunt among these vast plains and forests, and barter English goods with the tribes of the interior for their portion of the spoils of the chase.

The few settlements or factories round Hudson Bay are at the mouths of rivers, and well fortified: they are Forts Churchill, York, Albany, and Moose; there are other smaller settlements in the interior, on the great rivers. After the French were driven from Canada, a rival company was established, to trade with the Indians from Montreal, called the North-West Company. They entered these regions by the great Canadian Lakes, built numerous forts near those of their older rival, invading their chartered rights. For a great part of a century they were almost at open war; several collisions took place between their people, and in one of these twenty-three lives were lost. Lately the interests of these great rivals have been joined, to the great advantage of both; and they are now so powerful a body as to defy all chance of successful competition. To their establishments in the Oregon Territory is due the superior strength of the English power in those districts. Nearly all the Indian tribes are friendly and obedient to them, and as ready to defend them in war, as to serve them in peace.

The British possessions, lying to the north and west of Canada, contain three millions seven hundred thousand square miles of land —a greater extent than the whole of the United States. Vast though it be, only a small part of this dominion can be inhabited by civilised man: from the remainder, the Desert and the Polar snows shut him out for ever. To the west, along the favoured shores of the Pacific, millions upon millions of the human race could find abundant sustenance. —WARBURTON'S *Hochelaga.*

THE INDIAN.

Now had the autumn day gone by, and evening's yellow shade
Had wrapt the mountains and the hills, and lengthen'd o'er the glade.
The honey-bee had sought her hive, the bird her shelter'd nest,
And in the hollow valley's gloom both wind and wave had rest.

And to a cottar's hut that eve there came an Indian chief;
And in his frame was weariness, and in his face was grief.
The feather o'er his head that danced was weather-soil'd and rent,
And broken were his bow and spear, and all his arrows spent.

And meek and humble was his speech, he knew the white man's hand
Was turn'd against those wasted tribes, long scourgèd from the land.
He pray'd but for a simple draught of water from the well,
And a poor morsel of the food that from his table fell.

He said that his old frame had toil'd a wide and weary way,
O'er the sunny lakes and savage hills and through the woods that day.
Yet when he saw they scoff'd his words, he turn'd away in woe,
And cursed them not, but only mourn'd that they should shame him so.

When many years had flown away, that herdsman of the hill
Went out into the wilderness the wolf and bear to kill—
To scatter the red deer, and slay the panther in his lair,
And chase the rapid moose that ranged the sunless forests there.

And soon his hounds lay dead with toil, the deer were fierce and fleet,
And the prairie tigers kept aloof when they heard his hostile feet.
No bread was in that desert place, nor crystal rivulèt
To slake the torment of his thirst, or his hot brow to wet.

He fear'd—he fear'd to die—yet knew that nought on earth could save;
For none might catch his parting breath and lay him in his grave.
But low! while life's dim taper still burn'd feebly in his breast,
A ministering angel came—his hated Indian guest!

He shared his wheaten loaf with him, his cup of water shared,
And bore the sick man unto those for whom his heart most cared.
"I cursed thee not," the Indian said, "when thou wast stern to me,
And I have had my vengeance now; white man! farewell to thee!"

—M'LELLAN.

WAR BETWEEN THE IROQUOIS AND ERIES.

THE nation of the Cats, or Eries, had sent thirty ambassadors to the Iroquois, to confirm the peace which existed between them, but it happened that an Iroquois was killed in an accidental encounter by one of the Cat nation. His murder so exasperated the Iroquois that they put to death the ambassadors who were among them, with the exception of five who escaped. Thus, then, war was kindled between these two nations; the question now was who should get most prisoners to burn. Among others, two Onondagas were taken by the Cats; one escaped, and the other, a man of some importance, having been brought to the village to undergo the fiery ordeal, pleaded his cause so well, that he was given to the sister of one of the thirty ambassadors put to death. She was not then in the village, but they did not fail to attire the man in gay habiliments; feasting and good cheer alone prevailed. They assured him that he should be sent back to his country. When she to whom he had been given returned, they informed her that her dead brother had come to life again, and that she must prepare to treat him well and to dismiss him graciously. She, on the other hand, commenced to weep; she protested that she would never dry her tears till the death of her brother was avenged. The elders represented to her the importance of the matter—that it would bring a fresh war upon their hands—but she cared nothing for that. At last, they were obliged to give up the unfortunate man to her will. While this conference was going on, he had been delighting himself at the banquet. They dragged him away from the feast, and led him into the wigwam of this cruel woman without speaking. Upon his entrance, he was surprised that they took away his fine attire: soon he saw that his death was decided on. Before dying, he cried out that they were burning a whole people in his person, and that his death would be cruelly avenged. This was true; for the news had hardly been carried to the camp of the Onondagas,* when twelve hundred determined men started on the war-path, to obtain satisfaction for this affront.

We have already remarked that the nation of the Cats bears this name on account of the great number of very large and handsome wild-cats found in the country which it occupies. This country is very temperate; neither ice nor snow are seen there in winter, and during the summer grain and fruit of extraordinary size and quality are, it is said, gathered there.

The Onondaga warriors made such rapid marches, that although far from their own village, they arrived in the enemy's country without it being known. This spread such an alarm, that villages and houses were abandoned to the mercy of the conquerors, who,

* One of the five tribes of which the Iroquois confederacy consisted.

after having burned everything, set out in pursuit of the fugitives. These numbered two or three thousand warriors, exclusive of the women and children. Finding themselves closely pursued, they resolved, after a flight of five days to make a log-fort, and there to await their enemies, who numbered only twelve hundred. They entrenched themselves as well as they were able. Soon the enemy made his advances; two of the most distinguished chiefs, dressed after the French fashion, appeared, in order to frighten the Cats by the novelty of their garb. One of them, who had been baptized by Father Le Moine, and was well educated, mildly requested the besieged to surrender, failing which no quarter would be shown them. "The Lord of Life fights for us," said he, "and you are lost if you resist him." "Who is lord of our lives?" replied the besieged, haughtily; "we recognise no others than our arms and our hatchets." Thereupon the assault was made; the palisade was attacked on all sides, and as well defended as attacked. For a long time the battle lasted, and with great carnage on both sides. The besiegers made every effort to carry the place by storm, but it was in vain: all who showed themselves were killed. The assailants formed the plan of using their canoes as shields, and, under the shelter they afforded, arrived at the foot of the entrenchments. But they had yet to clear the great stakes and logs of which it was built. They piled up their canoes, and made use of them as scaling-ladders to mount this high palisade. Such boldness so much amazed the besieged, that, being already at the end of their ammunition, with which, especially powder, they had been ill-provided, they took to flight, thus causing their own destruction; for most of the foremost fugitives having been killed, the rest were hemmed in by the Onondagas, who entered the fort, and made such a slaughter of women and children that in some places there was blood up to the knee. Those who had escaped, wishing to regain their honour, after having collected their courage, in a short time retraced their steps, to the number of three hundred, with the intention of surprising the enemy while off his guard. The design was good, but it was badly executed; for, being terrified at the first cry the Onondagas made, they were entirely defeated. The conquerors also lost a number of their men, so that they were obliged to remain two months in the enemy's country to bury their dead and heal their wounded. —*Relations des Jesuites.*

PHILOLOGY—HISTORY IN WORDS.

HAVING dedicated this lecture to the history which is in words, I can have no fitter opportunity of urging upon you the importance of seeking in every case to acquaint yourselves with the circumstances under which any body of men, that have played an important part in history, especially in the history of your own land, obtained the name by which they were afterwards willing to be known, or which was used for their designation by others. This you may do as a matter of historical inquiry, and keeping entirely aloof in spirit from the scorn, the bitterness, the falsehood, the calumny, out of which very often this name was first imposed. Whatever of this evil may have been at work in them that coined, or gave currency to the name, the name itself can never without serious loss be neglected by those who would truly understand the moral significance of the thing; there is always something, often very much, to be learned from it. Learn, then, in regard of each one of these names which you may meet in your studies, whether it was one which men gave to themselves, or one imposed on them by others, was yet in course of time admitted and accepted by themselves. We have examples in all these kinds. Thus the "Gnostics" called *themselves* such; the name was of their own devising, and one in which they boasted. In like manner, the "Cavaliers" of our civil war. "Quaker," "Puritan," "Roundhead," were all, on the contrary, names devised by others, and never accepted by those to whom they were attached; while "Whig" and "Tory" were nicknames originally of bitterest scorn and party hate, given by two political bodies in England to one another, which, however, in course of years, lost what was offensive in them, until they came to be accepted and employed by the very parties themselves. The German "Lutherans" were first so called by their antagonists. The same we may say of "Methodists;" this name was certainly not first taken by the followers of Wesley, but imposed on them by others, while yet they have been subsequently willing to accept and to be known by it. "Capuchin" was in like manner a jesting name, first given by the boys in the streets to that branch of the Franciscans which afterwards accepted the name as their proper designation. It was provoked by the peaked and pointed hood (capucho) which they wore.

Now of these titles, and of many more that might be adduced, some undoubtedly, like the last, had their rise in mere external accident, and stand in no essential connexion with those that bear them; and these names, although seldom without their instruction, yet plainly are not *so* instructive as others in which the innermost heart of a system speaks out and reveals itself; so that, having mastered the name, we have placed ourselves at the central point from which we shall best master everything besides. Thus, for instance, is it with "Gnosticism" and "Gnostic;" in the prominence given to *gnosis*, or knowledge, as opposed to faith, lies the key of the whole system. And I may say generally, that almost all the sects and parties, religious and political, which have risen up in times past in England, are known by names that will repay study; by names, to understand which will bring us far to an understanding of their strength and their weakness, their truth and their error, the idea and intention according to which they wrought. "Puritans," "Fifth-Monarchy Men," "Seekers," "Levellers," "Independents," "Friends," "Rationalists," "Latitudinarians," "Freethinkers;" these titles, with many more, have each its significance; and, would you understand what the men themselves meant, you must first understand what they were called. From this must be your point of starting; even as to this you must bring back whatever further information you may gain; and, though I will not say that you must always subordinate it to the name, yet you must ever put it in relation and connexion with that.

You will often be able to glean knowledge from the names of things, if not as important as that I have just been speaking of, yet curious and interesting. What a record of inventions is preserved in the names which so many articles bear, of the place from which they first came, or the person by whom they were first invented. The "magnet" has its name from Magnesia; the "baldachin" from "Baldacco," the Italian name of Bagdad, it being from that city that the costly silk which composed this canopy originally came. The "bayonet" tells us that it was first made at Bayonne; "worsted" that it was first spun at a village of the same name (in the neighbourhood of Norwich); "sarsnet," that it is a Saracen manufacture; "cambrics," that they reached us from Cambray; "crape," from Cyprus, (the earlier form of the word is "Cypres"); "copper," also, that it drew its name from this same island, so richly furnished with mines of this metal; "diaper," that it came from Ypres; "damask," from Damascus, (the damson is also the "damascene," or Damascus plum;) "arras," from Arras; "dimity," from Damietta; "cordwain" or "cordovan," from Cordova; "currants," from Corinth; "delf," from Delft; "indigo," (indicum,) from India; "agates," from a Sicilian river, Achates; "jalap," from Xalapa, a town in Mexico; "parchment," from Pergamum; the "bezant," so often named in our early literature, from Byzantium, being a Byzantine coin; the "guinea," that it was originally coined (in 1663) of gold brought from the African coast so-called; "camlet," that it was woven, at least in part, of camel's hair. The fashion of the cravat was borrowed from the Croats, or "Crabats," as they used in the seventeenth century to be called. The "biggen," a plain cap often mentioned by our early writers, was first worn by the Beguines, communities of pietist women in the middle ages, and had its name from them. Such has been the manufacturing progress of England, that we now send our calicoes and muslins to India and the East; yet the words give standing witness that we once imported them from thence; for "calico" is from Calicut, and "muslin" from Moussul, a city in Asiatic Turkey. "Ermine" is the spoil of the Armenian rat; "sherri," or "sherris," as Shakespeare wrote it, is sent us from Xeres; the "pheasant" came to us from the banks of the Phasis; the "cherry" was brought by Lucullus from Cerasus, a city in Pontus; the "peach" declares itself by its name to be a Persian fruit; "spaniels" are from Spain.

It is true, indeed, that occasionally a name will embody and give permanence to an error; as when in "America," the honour of discovering the New World, which belonged to Columbus, has been transferred to another eminent discoverer, but one who had no title to this praise, and who, as Humboldt has lately abundantly shown, was entirely guiltless of any attempt to usurp it for himself. So, too, the "turkey" in our farmyards seems to claim Turkey for its home, and the assumption that it was from thence no doubt caused it to be so-called; while, indeed, it was unknown in Europe until introduced from the New World, where alone it is indigenous. This error the French in another shape repeat, calling it "*dinde*," originally "poulet *d'Inde*," or Indian fowl. In like manner, "gipsies" appears to imply that Egypt was the country to which these wanderers originally belonged, and from which they had migrated westward; and certainly it was so believed in many parts of Europe at their first appearance in the beginning of the fifteenth century, and hence this title. It is now, however, clearly made out, their language leaving no doubt of the fact, that they are an outcast tribe which has wandered hither from a more distant land—from India itself. "Bohemians," the French appellation of gipsies, involves an error similar to ours; they were taken at first by the common people in France to be the expelled Hussites of Bohemia, and hence this name. In the German "Zigeuner," there is no expression of the land from which they were presumed to have come; but if this word be "Zieh-Gauner,"—that is, "roaming thieves,"—it will indicate the evil repute in which, from the very beginning, they were held.

And where words have not, as in these cases, embodied an error, it will yet sometimes happen that the sound or spelling of a word will *to us* possibly suggest a wrong explanation, against which in these studies we will need to be on our guard. I daresay that there has been a stage in most boys' geographical knowledge when they have taken it for granted that Jutland was so called, not because it was the land of the Jutes, but on account of its *jutting* out into the sea in so remarkable a manner. And there have not been wanting those who have ventured to trace in the name "Jove" a heathen reminiscence of the awful name of Jehovah. I will not enter into this here; sufficient to say that, however specious this at first sight may seem, yet on close examination of the two words every connexion between them disappears.

Sometimes the assumed derivation has reacted upon and modified the spelling. Thus the name of the Caledonian tribe whom we call the "Picts" would probably have come down to us in a somewhat different form, but for the assumption which early rose up, that they were so called from their custom of staining or painting their bodies—that, in fact, "Picts" meant "the painted." This, as is now acknowledged, is an exceedingly improbable supposition. It would be quite conceivable that the Romans should have given this name to the *first* barbarous tribe they encountered who were in the habit of painting themselves thus—such a custom, forcing itself on the eye, and impressing itself on the imagination, is exactly that which gives birth to a name—but after they had been long familiar with the tribes in southern Britain, to whom this painting or tatooing was equally familiar, it is quite inconceivable that they should have applied it to one of the northern tribes in the island, with which they first came in contact at a far later day. The name is much more probably the original Celtic one belonging to the tribe, slightly altered in the mouths of the Romans. It may have been the same with "hurricane;" for many have imagined that this word, being used especially to signify the West Indian tornado, must be derived from the tearing up and *hurrying* away of the *canes* in the sugar plantations—just in the same way as the Latin "calamitus" has been drawn, but erroneously, from "calamus," the stalk of the corn. In both cases the etymology is faulty; "hurricane" is only a transplanting into our tongue of the Spanish "hurracan" or the French "ouragan."

It is a signal evidence of the conservative powers of language, that we oftentimes trace in speech the records of customs and states of society which have now passed so entirely away as to survive nowhere else but in these words alone. For example, a "stipulation," or agreement, is so called, as many tell us, from "stipula," a straw, and with reference to a Roman custom of breaking a straw between them when two persons would make a mutual engagement with one another. And we all know how important a fact of English history is laid up in "curfew," or "couvre-feu." The "limner," or "lumineur," (luminatore,) brings us back to a period when the *illumination* of manuscripts was the leading occupation of the painter, so that from this work he derived his name. "Thrall" and "thraldom" descend to us from a period when it was the custom to *thrill*, or drill the ear of a slave in token of servitude, a custom in use among the Jews, (Deut. xv. 17,) and retained by our Anglo-Saxon forefathers, who were wont thus to pierce at the church-door the ears of their bond-servants. By "lumber" we are, or might be, taught that Lombards were the first pawnbrokers, even as they were the first bankers in England, a "lumber"-room being a "lombard"-room, or room where the pawnbroker stored his pledges. Nor need I do more than remind you that in our common phrase of "*signing* our name," we preserve a record of a time when the first rudiments of education, such as the power of writing, were the portion of so few, that it was not as now the exception, but the custom for most persons to make their mark or "sign," great barons and kings themselves not being ashamed to set this *sign*, or cross, to the weightiest documents. We more accurately express what we now do when we speak of "subscribing the name." Then, too, whenever we term arithmetic the science of "calculation," we in fact allude to that rudimental period of the science of numbers when pebbles (calculi) were used, as now among savages they often are, to facilitate the practice of counting. The Greeks did the same in their word ψηφίζειν, as in another word of theirs (πεμπαζειν) record of a period was kept when the *five* fingers were so employed. "Expend," "expense," tell us that money was once weighed out, and not counted out, as now, (Gen. xxxiii. 16.) In "library," we preserve the fact that books were once written on the bark (liber) of trees; as in "paper," of a somewhat later period, when the Egyptian papyrus, "the paper reeds by the brooks," furnished the chief material for writing.

Theories, too, which long since were utterly renounced, have yet left their traces behind them. Thus the words "good humour," "bad humour," "humours," and, strangest contradiction of all, "*dry* humour," rest altogether on a now exploded, but a very old and widely-extended theory of medicine, according to which there were four principal moistures or "humours" in the natural body, on the due proportion and combination of which the disposition alike of body and mind depended. And "temper," as used by us now, has its origin in the same theory: the due admixture, or right "tempering" of these gave what was called the happy temper, or mixture, which, thus existing inwardly, manifested itself also outwardly. In the same manner "distemper," which we still employ in the sense of sickness, was that evil frame either of a man's body or of his mind, (for it was used alike of both,) which had its rise in an unsuitable mingling of these humours. In these instances, as in many more, the great streams of thought and feeling have changed their course, and now flow in quite other channels from those which once they filled, but have left these words as lasting memorials of the channels in which once they ran. —TRENCH's *Study of Words.*

ARCHÆOLOGY—DISCOVERIES AMONG THE RUINS OF NINEVEH.

ON the morning following these discoveries, I rode to the encampment of Sheikh Abd-ur-rahman, and was returning to the mound, when I saw two Arabs of his tribe urging their mares to the top of their speed. On approaching me they stopped. "Hasten, O Bey," exclaimed one of them, "hasten to the diggers, for they have found Nimrod himself. Wallah! it is wonderful, but it is true! we have seen him with our own eyes. There is no God but God;" and both joining in this pious exclamation, they galloped off, without further words, in the direction of their tents.

On reaching the ruins I descended into the new trench, and found the workmen, who had already seen me as I approached, standing near a heap of baskets and cloaks. Whilst Awad advanced, and asked for a present to celebrate the occasion, the Arabs withdrew the screen they had hastily constructed, and disclosed an enormous human head, sculptured in full out of the alabaster of the country. They had uncovered the upper part of the figure, the remainder of which was still buried in the earth. I saw at once that the head must belong to a winged lion or bull, similar to those of Khorsabad and Persepolis. It was in admirable preservation. The expression was calm yet majestic, and the outline of the features showed a freedom and knowledge of art scarcely to be looked for in the works of so remote a period. The cap had three horns, and, unlike that of the human-headed bulls hitherto found in Assyria, was rounded, and without ornament at the top.

I was not surprised that the Arabs had been amazed and terrified at this apparition. It required no stretch of imagination to conjure up the most strange fancies. This gigantic head, blanched with age, thus rising from the bowels of the earth, might well have belonged to one of those fearful beings, which are pictured in the traditions of the country as appearing to mortals, slowly ascending from the regions below. One of the workmen, on catching the first glimpse of the monster, had thrown down his basket and run off towards Mosul as fast as his legs could carry him. I learnt this with regret, as I anticipated the consequences.

Whilst I was superintending the removal of the earth, which still clung to the sculpture, and giving directions for the continuation of the work, a noise of horsemen was heard, and presently Abd-ur-rahman, followed by half his tribe, appeared on the edge of the trench. As soon as the two Arabs had reached the tents, and published the wonders they had seen, every one mounted his mare and rode to the mound, to satisfy himself of the truth of these inconceivable reports. When they beheld the head they all cried out together, "There is no God but God, and Mohammed is his prophet!" It was some time before the sheikh could be prevailed upon to descend into the pit, and convince himself that the image he saw was of stone. "This is not the work of men's hands," exclaimed he, "but of those infidel giants of whom the prophet, peace be with him! has said, that they were higher than the tallest date tree; this is one of the idols which Noah, peace be with him! cursed before the flood." In this opinion, the result of a careful examination, all the bystanders concurred.

I now ordered a trench to be dug due south from the head, in the expectation of finding a corresponding figure, and, before nightfall, reached the object of my search about twelve feet distant. Engaging two or three men to sleep near the sculptures, I returned to the village, and celebrated the day's discovery by a slaughter of sheep, of which all the Arabs near partook. As some wandering musicians chanced to be at Selamiyah, I sent for them, and dances were kept up during the greater part of the night. On the following morning, Arabs from the other side of the Tigris, and the inhabitants of the surrounding villages, congregated on the mound. Even the women could not repress their curiosity, and came in crowds, with their children, from afar. My Cawass was stationed during the day in the trench, into which I would not allow the multitude to descend.

As I had expected, the report of the discovery of the gigantic head, carried by the terrified Arab to Mosul, had thrown the town into commotion. He had scarcely checked his speed before reaching the bridge. Entering breathless into the bazaars, he announced to every one he met that Nimrod had appeared. The news soon got to the ears of the Cadi, who, anxious for a fresh opportunity to annoy me, called the Mufti and the Ulema together, to consult upon this unexpected occurrence. Their deliberations ended in a procession to the governor, and a formal protest, on the part of the Mussulmans of the town, against proceeding so directly contrary to the laws of the Koran. The Cadi had no distinct idea whether the bones of the mighty hunter had been uncovered, or only his image; nor did Ismail Pasha very clearly remember whether Nimrod was a true-believing prophet, or an infidel. I consequently received a somewhat unintelligible message from his excellency, to the effect that the remains should be treated with respect, and be by no means further disturbed; and that he wished the excavations to be stopped at once, and desired to confer with me on the subject.

—LAYARD.

RUINS OF PÆSTUM.

THEY stand between the mountains and the sea
Awful memorials—but of whom we know not!
The seaman, passing, gazes from the deck.
The buffalo-driver, in his shaggy cloak,
Points to the work of magic, and moves on.
Time was they stood along the crowded street,
Temples of Gods! and on their ample steps
What various habits, various tongues beset
The brazen gates, for prayer and sacrifice!
How many centuries did the sun go round
From Mount Alburnus to the Tyrrhene sea,
While, by some spell render'd invisible,
Or, if approach'd, approach'd by Him alone
Who saw as though He saw not, they remain'd
As in the darkness of a sepulchre,
Waiting the appointed time! All, all within

Proclaims that Nature had resumed her right,
And taken to herself what man renounced;
No cornice, triglyph, or worn abacus,
But with thick ivy hung or branching fern,
Their iron-brown o'erspread with brightest verdure!
From my youth upward have I long'd to tread
This classic ground.—And am I here at last?
Wandering at will through the long porticoes,
And catching, as through some majestic grove,
Now the blue ocean, and now, chaos-like,
Mountains and mountain-gulfs! and half-way up,
Towns like the living rock from which they grew?
A cloudy region, black and desolate,
Where once a slave withstood a world in arms.
The air is sweet with violets, running wild
'Mid broken sculptures and fallen capitals!
Sweet as when Tully, writing down his thoughts,
Sail'd slowly by, two thousand years ago,
For Athens; when a ship, if north-east winds
Blew from the Pæstan gardens, slack'd her course.
The birds are hush'd a while, and nothing stirs,
Save the shrill-voiced cigala flitting round
On the rough pediment to sit and sing;
Or the green lizard rustling through the grass,
And up the fluted shaft, with short quick motion,
To vanish in the chinks that Time has made!
In such an hour as this, the sun's broad disk
Seen at his setting, and a flood of light
Filling the courts of these old sanctuaries,
(Gigantic shadows, broken and confused,
Across the innumerable columns flung,)
In such an hour he came, who saw and told,
Led by the mighty Genius of the Place!
Walls of some capital city first appear'd,
Half razed, half sunk, or scatter'd as in scorn;
And what within them? what but in the midst
These Three, in more than their original grandeur,
And, round about, no stone upon another!
As if the spoiler had fallen back in fear,
And turning, left them to the elements.

—Rogers.

WANDERINGS OF MAN.

WHAT shall we say of the wanderings of man? His history is still darker than that of his servants, and his first home, an Eden, is truly defended, even now, by an angel with a flaming sword. The place where his cradle stood is utterly unknown. The first period of his life is veiled in dark night; only a few brief flashes of light are, by revelation, thrown upon it, which reveal but a single moment in a long period, and, consequently, barely allow us to guess at the connexion, without giving us anything like continuous information.

It is not a little singular that one of the strongest arguments in support of the favourite idea of man's first home, and the unity of his race, is derived from the analogy between him and plants and animals. As the latter invariably accompany man, and as they all came from the table-lands of Central Asia, so it is said man also came probably from that portion of our globe, though, without doubt, at a time when the now dry and sterile heights were still the luxuriant tropical valley of Eden. For geologists tells us we may with good reason presume that these rich low grounds were by some mysterious convulsion raised slowly and steadily, and thus the races of men scattered abroad into the adjoining fertile valleys.

When this happened we know not. It must have been far beyond the reach of history, legend, or vague tradition. Even the oldest races of the earth, whose myths, fables, or songs, whose features or language, point to the distant East with greatest certainty—even these found their land already in possession of others.

Thus the Celts, among the oldest nations of Europe, when they arrived from their far eastern cradle, encountered in Europe already nations whose imperfect language, lawless manners, and superstitious faith, showed how long they had been separated from their early home, and from their former intimate communion with the Creator. Nay, these Celts themselves, coming as they did as one of the very first waves of immigration from Asia, were already comparative barbarians, having lost both the culture and the faith of our first fathers. If, then, so little is positively known of the condition of the West of Europe and the ancestors of the present masters of the globe, much less can be gathered as to the state of things in the East itself. Still, wherever legends speak, however dimly, wherever traditions begin to shed a faint and often treacherous light upon the first condition of powerful nations—everywhere immense hordes of emigrants are seen to pour forth, age after age, from the same common centre in middle Asia. Chinese myths speak of an immigration from the West about two thousand years before Christ, and the "Vendidad" of the Zendavesta says that the early Persians came under Schemscid from eastern tablelands down into the "four-cornered-land," their present home.

But far more positive and certain are the traditions of the three greatest races on earth, both on account of the antiquity and comparative authenticity of their legends, and on account of the intrinsic evidence drawn from the mutual relationship in which they stand to each other.

The Hindoos, whom we venerate as the oldest of known civilised nations, derive their origin from the north-west, and call "Hindu-Kush" and "Belustag," in their traditions, invariably the boundary-mountains, behind which their birthplace is hidden.

The Semitic nations also point to the East as their common home, and to the Ararat as the landmark which divides their first home from their present residence.

Now, exactly between the Ararat and the Belustag lies that vast tableland, which most men are disposed to consider the birthplace of the first among men. Both Indian and Semitic races brought with them to their new dwelling-places, not only an indistinct recollection of their former home, but many rich treasures of their former civilisation; in one word, a history of their people. These elements they rapidly developed to a high degree of power and culture; but the latter withered and disappeared as rapidly again, for it was not grown on its native soil, not favoured by the sun of their true home. Hence they either ceased to have a real history, as the Chinese and the Indians, or they became rude barbarians, as the Semitic races.

Different, however, was the destiny of the third great family of men, the Indo-Germans, who probably left, last of all children, the paternal home of the East. In millions they poured, wave after wave, of migrating nations into Europe, the last of which, fortunately, belongs already to historical times, and, under the well-known name of the great Migration of Nations, changed completely the whole ethnography of Europe. Still, among all the numerous Indo-German nations, there lives not a single legend connected with the time of their existence in Asia. They seem to have broken with the past for ever, to have utterly abandoned their early home, and perhaps even the civilisation which they left behind them. They have devoted themselves instead, to that grand future, which alone seems to embody and to realise the great destiny of mankind.

The only great riddle in the history of the migrations of men, to which neither revelation nor science has as yet offered the key, is the origin of the natives of the American continent. Surmises abound, from the most absurd to the most plausible. The poor redskins have been at will transformed into exiled Jews or banished Chinese; their language has been called Syriac, Welsh, and Celtic.* Their traditions speak simply and vaguely of a rude original race, which lived in the fertile plains of the West, mainly, and of a more powerful and more civilised race, which, at a later period, came from the north, moved victoriously southward, and subjugated the early owners of the soil. The difference of the two contending races is confirmed by the study of their skulls. But we know not whence the native settlers came, nor whence the foreign invaders. It is conjectured, and with good reason, that, as the American continent is geologically older than that of Europe, so, its occupation also dates from times previous to the Christian history of the old world. In those days, however, the nations of Asia are invariably represented as leading a pastoral life, and as having, consequently, long domesticated the ox and the sheep. It is then in the highest degree improbable that emigrants of those times should have left their incalculable blessings behind them; if, as many believe, they went from Asia by a north-west passage across the Atlantic to America. Yet no trace of domestic animals was found there. As improbable, however, is it that, if by accident they should have been compelled to leave them behind, they should not at once have set to work, in continuance of ancient custom, to tame the buffalo, the vicuna, and the alpaca, as the Europeans did when they arrived on the American continent.

Setting this only great riddle aside, and resuming all that myths, traditions, and revelation itself tell us, so much only seems to be certain, that all migrations of men, like those of plants and animals, have gone from the rising to the setting sun. Everywhere history begins with an immigration of Eastern races. In Southern Europe appeared the seafaring Pelasgi; they were soon followed by the Etruscans; then came the Helleni. From the table-lands of the Waldai, we see next the Istuni, or Fins, driven westward by the pressure of countless Teutons. The latter, together with Sclaves, soon rush into Germany, Scandinavia, and France. The same phenomenon, in fact, is constantly repeated. New waves of new nations roll on from the East, and shake the foundations of older, well-organised kingdoms, until Columbus opens the western gate to

* The Welsh is a Celtic language.—ED.

let loose the rising stream of Asiatic races, which now flood the new continent.

This resistless movement toward the west is yet unbroken, unrelenting. The same great law of nature impels man towards the setting sun, and all his efforts to travel eastward have been ingloriously foiled. In vain did millions of brave pious men rush to the orient to reconquer the Holy Land; in vain were the most chivalrous courage, the most devoted self-sacrifice, employed against the stern eternal rule of nature. No great expedition to the East has ever been successful and permanent. Vast distances have been traversed, vast reverses sustained, and hardships incredible endured, only to result in grand defeats, like the Anabasis of the younger Cyrus, and the retreat of the noble Ten thousand. And so it is still in our day. As recently as the latter part of the last century, a whole Tartar nation, several hundred thousands of Kalmucks, with all their herds, left Southern Russia, and fled across the boundless steppes of Asia, to escape the iron rule of the Russian sceptre. They left unimpeded; they were allowed to defy their masters' vengeance; but they could not disobey the great law of nature. A few beggars returned, long years after, to report that the whole tribe had perished, a whole nation had disappeared from the globe! And the same law called to Napoleon, when he was at the height of his power, sternly uttering the Scripture words, "hitherto shalt thou come, but no further!"

Man moves with the sun: the East is his cradle, the West his goal. —*Putnam's Magazine.*

ETHNOLOGY—NORTH AMERICAN INDIANS.

It must be borne in mind that there is as broad a distinction between Indian nations, and even the tribal bands of the same nation, as between Europeans or Asiatics of separate origin or nationality. The stately and intelligent Ojibways, who formerly occupied the country about Lake Superior and the north shore of Lake Huron, and are now scattered from Lake Ontario to the Grand Forks of the Saskatchewan, ought not to be brought into comparison and classed with the barbarous Mistassins, who hunt and fish on the Lower St Lawrence, although both nations belong to the same great family and speak dialects of a common language. Much misapprehension and perplexity have arisen from the different application by writers of the terms "family," "nation," "tribe," and "band" in describing the peculiarities of the Indian race. At the present day, five great Indian "families," as distinguished by languages of a radically distinct character, occupy the northern portion of the North American continent east of the Rocky Mountains. They are as follows:—

1. Esquimaux.
2. Chipewyans.
3. Algonquins.
4. Dakotahs.
5. Iroquois.

The Esquimaux occupy the Arctic coast, and are, essentially, a maritime people; the Chipewyans, the region south of the country of the Esquimaux, and live in the woods north of the 55th parallel. The Algonquins are in possession of the valley of the St Lawrence and of the country north of a line drawn from the head waters of the Mississippi to the north branch of the Saskatchewan; they are part prairie, and part wood Indians. The Dakotahs occupy the valley of the Missouri, and a considerable portion of the Upper Mississippi. They also extend their hunting expeditions to the north branch of the Saskatchewan, confining themselves throughout this vast region to the prairies and plains. The Iroquois must be regarded as a family nearly extinct; they are half civilised, and, from intermixture with the whites, fast losing, in many of their settlements, all trace of pure Indian blood.

When the Jesuit missionaries penetrated into Canada, about the year 1615, they found the country in possession of two only of these families, the Algonquins and the Iroquois.

The great Algonquin family, whose hunting grounds then extended from the north-west side of the valley of the St Lawrence to Hudson Bay, is composed of numerous nations, speaking a common language, but embracing many dialects. Among them are included the Ojibways, the Crees, the Potawatamies, the Shawnees, the Lenni-Lenape, the Delawares, the Ottawas, the Nippissings, the Abenakis, the Amalacites, the Montagnais, the Sokasis, the Mistassins, and the Mohegans. The Algonquins are generally wanderers, without settled place of abode, living in the woods and subsisting upon wild animals, fish, fruits, roots, and herbs.

The Iroquois family embraced the Hurons, Eries, and Mingoes or Iroquois. The Hurons or Wyandots speak a language not understood by the Algonquin nations, but allied to that of the Iroquois. They lived formerly in stationary villages, and cultivated the soil, growing Indian corn, pumpkins, &c. The country of the Hurons is now the county of Simcoe in Western Canada, and the once celebrated missions of St Ignace, St Louis, and Ste Marie were respectively situated at or near the extremities of Sturgeon, Hog, and Gloucester Bays of Lake Huron. The Hurons occupied this limited area with a population of about 30,000 souls, living in eighteen walled villages, until the year 1650, when they were destroyed or dispersed by the murderous Iroquois. When the remnant fled from their enemies, they separated into five divisions; the first band retired to the Manitoulin Islands, but eventually joined another part of the fugitives who had fled to Quebec, where their descendants occupy the village of La Jeune Lorette. The second band applied to be received into the families of their conquerors, and they were incorporated with the Tsounontouans of the five nations of the Iroquois. The third band found a temporary asylum in the island of Michillimakinac at the upper extremity of Lake Huron, but, being followed by the Iroquois, they retreated to the Mississippi, where they encountered the Sioux, who, at this time, were engaged in extending their territory towards the east, like the Iroquois in the contrary direction. The unfortunate Hurons retired to the shores of Lake Superior, but were followed by the Sioux and ultimately compelled to retrace their steps to Michillimakinac, about the year 1670, where the remnant now dwells. The fourth and most ill-fated of the Huron bands sought refuge among the Eries, who occupied the country on the north shores of Lake Erie. They spoke the same language as the Hurons and Iroquois, and lived in permanent villages. The presence of the Hurons among them soon excited the jealousy of the Iroquois, so that, after a very short period had elapsed, both the Eries and the greater part of their Huron allies were cut off by the savage, envious, and relentless Iroquois. The fifth band retired to the new French colony in the lower St Lawrence, where they were joined by the first band, as already stated. According to the narrative of Sagard, the first historian of the Hurons, they occupied a distinguished position among savage nations. The Hurons represented the nobility of the country, some of the Algonquin nations represented the citizens, and the Montagnais, an Algonquin nation, the poor.

The Iroquois Confederation consisted, originally, of a union of five nations, named respectively the *Mohawks*, the *Oneidas*, the *Onondagas*, the *Cayugas*, and the *Senecas*. They invaded the country of the Hurons about 1650, and were, in turn, driven back by the Algonquins, into whose hunting grounds, north and north-east of Lake Huron, they appear to have penetrated. After their retreat, the Ojibways, and particularly the Mississaguas, the *eagle* tribe of the Ojibways, following them, occupied permanently the central portion of the peninsula of Western Canada. In 1712, the Tuscaroras of North Carolina, subsequently to their defeat by the English, united with the Iroquois, and formed with them the confederacy of the Six Nations. At the time of the first discovery of Canada, the Iroquois occupied the south-east valley of the St Lawrence, especially the south shore of Lake Ontario and the region about the small lakes which still bear the names of the different nations. At the close of the war of independence, being firm allies of the British, they migrated into Canada, and in 1784 a part were established on the Grand River, on a tract comprising about 700,000 acres, which was confirmed to them in 1789 by letters-patent. In 1845, there remained in the hands of these Indians, 52,133 acres, the other portion having been surrendered at different times. This part of the remnant of the famous Six Nations now numbers on the Grand River 2550, of which between five and six hundred are still Pagans. The Canadian Iroquois did not exceed 5000 in 1857.

—HIND.

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