A. S. Wakefield

Nov 26/85.

FRONTISPIECE.

"I happened to touch one of these called a Sensitive Plant." &c.

see page 45.

DOMESTIC

RECREATION;

OR,

DIALOGUES

ILLUSTRATIVE OF

NATURAL AND SCIENTIFIC SUBJECTS.

BY

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LONDON:

PRINTED FOR DARTON, HARVEY, & DARTON,

No. 55, Gracechurch-Street.

1813.

PREFACE.

THE author has been induced, by the favourable reception of *Mental Improvement,* to present her young readers with miscellaneous conversations, between a well-informed mother and her daughters, in which she has endeavoured to blend instruction with amusement. The subjects she has chosen, are such as are likely to have arisen in a family accustomed to observe with attention the objects around them; and, she trusts, are adapted to cultivate a love for the works of nature, and a habit of reflection.

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DOMESTIC RECREATION.

DIALOGUE I.

INSECTS.

MRS. DIMSDALE AND HER TWO DAUGHTERS.

Lucy.

MAMMA, I have found a beautiful insect; pray look at it, and tell me the use of these long horns.

Mrs. Dimsdale.

Most insects are furnished with them; they are called the antennæ, or feelers. It has been supposed, by some people, that they serve for a defence to the eyes, whilst others imagine that the creature uses them as a blind man would do his staff, to feel whether there is any obstacle in the way: but as insects have generally eyes to see on all sides, I am

inclined to believe they may be the organs of smell, or of some other sense with which we are not acquainted.

Emily.

The antennæ of a butterfly are very different from these.

Mrs. Dimsdale.

They vary in their form and structure extremely in different insects; and probably in their use, as the habits of the possessor may require.

Lucy.

I wish you would tell us how many kinds there are, and in what they differ from each other.

Mrs. Dimsdale.

As we happen to be at leisure, I will oblige you. Emily, take this key, and in my tortoiseshell cabinet you will find a drawer, in which there are the parts of many insects dried: bring it, and we will examine them.

Lucy.

Oh! how glad I am that you will indulge my

my curiosity. I am so fond of those tiny, beautiful creatures, that it is one of my favourite amusements to search for them on the plants in the garden; I mean merely to look at them, for I never hurt or confine them.

Mrs. Dimsdale.

Here is a variety of antennæ. These belonged to a lobster. You see how they are jointed; they will bend almost double. Many insects have them jointed likewise, others not; but almost all are moveable at the base: a peculiarity that distinguishes them from horns, which, you may recollect, are fixed. Some are thickest at bottom, and grow slender at the end; others the contrary; and many are tipped with tufts of hair, resembling a bunch of feathers.

Emily.

I have observed that in butterflies, and in the cockchafer.

Mrs. Dimsdale.

The antennæ of butterflies are not all alike: some are tipped with knobs instead of

plumes; and some are beset the whole length with feathers, like a quill. Some are long, in proportion to the size of the insect; others short; and others of a middle size.

Emily.

Are these bristles, standing near the mouth, or smaller antennæ?

Mrs. Dimsdale.

No; they are called feelers. There are generally four or six of them: whereas there are seldom more than a pair of antennæ. These feelers supply the place of hands, in bringing the food to the mouth, and supporting it whilst eating.

Lucy.

There is something, besides the antennæ and feelers, that projects from the head of this fly.

Emily.

It is the trunk. Have you never seen a bee suck honey out of the flowers?

Lucy.

Yes, often; but I did not look close, to see the trunk.

Mrs.

Mrs. Dimsdale.

Many insects have this instrument as well as bees: you may see it very plainly in the common fly. Scatter a little sugar on the table, and we shall presently have visitors enough to feed upon it.

Lucy.

There is one already; ah, I see his trunk: he dips it in the sugar, and draws it up as if he sucked through it. It is broad at the end, and appears to be bordered with a kind of lip.

Mrs. Dimsdale.

There is as great a variety in the trunks of insects as in their antennæ. Some are merely a tube, formed of one piece; whilst in others there are several pieces, nicely joined together. Some kinds are thin, like a shell; and others thick and fleshy: and some are in the form of a spindle, hollowed towards the end.

Lucy.

As they are designed for the same use, I am surprised that they are not alike in all insects.

Mrs. Dimsdale.

It is probable that the form and structure of the trunk vary according to the different kinds of food the insects eat. Some insects shorten or contract their trunk when they are not using it, or draw it into a hollow receptacle in the head. The trunks of bees, and some other flies, have the power of folding them, as if to keep them out of the way. The gnat has a case for his trunk, which guards it, stretched out at length; but he can incline it either way, that it may not interfere with his legs. Many butterflies have a very long trunk; but it takes very little room, from being curled up like the spring of a watch.

Emily.

Oh, I have observed that often; but did not know its use.

Mrs. Dimsdale.

Among the butterfly tribe, some scarcely settle upon any thing, but are continually upon the wing, like swallows. You may observe them buzzing about the flowers like

so many bees, and for the same purpose—to extract the honey from their inmost recesses, by unrolling their long trunk, and supporting themselves at the same time by their wings in the air. But remark, that many kinds of insects, and some butterflies, have no trunks; a distinction for which we might better account, if we knew their habits more intimately. There is also a great variety in the colour of the trunk, as well as in its structure; red, black, yellow, and different tints of brown, are seen in the numerous races of insects. It were endless to describe all the variations with minute nicety; for even in the same genus there are material distinctions, in the form of this little instrument.

Emily.

Is not this the leg of a grasshopper?

Mrs. Dimsdale.

Yes; observe the strength of the thigh, formed for leaping. The legs and feet are curiously adapted to the habits and motions of the insect to which they belong. Some

for

for running; others jumping; and many for swimming, whose feet are flat, and edged with hairs. The feet of the common fly are furnished with a gummy liquor, that enables it to creep up smooth substances, such as glass, without slipping: they are likewise supplied with hairs, resembling a brush, with which they clean their wings. Some insects have no claws; but their fore feet grow larger towards the end, and are divided into two parts, like a thumb and finger.

Lucy.

Worms and snails have neither legs nor feet.

Mrs. Dimsdale.

They are not insects, but belong to another class of animals. The characters by which insects are distinguished are these: they have a head, antennæ, and feet; neither of which is to be found in worms. They have never less than six feet, and often more. Their skin is hard, and serves them instead of bones, having none withinside like other animals. Their manner of breathing also is peculiar;

culiar; instead of lungs, placed in the chest, like quadrupeds, which inhale or exhale the air through the mouth, insects breathe through pores, called spiracula, placed on the sides of their bodies. The head is destitute of brain, ears, or nostril; but perhaps the antennæ are the organs of hearing or smell, or of both of them; for it is difficult for us, who are so differently formed, to have any clear idea of the senses bestowed by the Universal Father, on this tribe of minute animals.

Emily.

I observe you have a great number of wings in your drawer; some of them are like gauze, others horny, and some covered with fine dust or feathers, of the most beautiful colours.

Mrs. Dimsdale.

These last belonged to butterflies and moths. If the feathers are rubbed off, you will admire the curious structure of the wing itself, formed for strength and resistance against the air. The ribs, which all proceed from that part that is fixed to the body, may

may be compared to bones: the largest and thickest surround the outer edge of the wing; the next size extend along the inner edge; and the others branch out in various directions along the middle, like the fibres of a leaf. Some insects have four wings, and many but two; but the deficiency is made up by two little balls, or poisers, united to the body under the hinder part of each wing; which serve the insect for a balance, and enable it to keep steady, and guide itself in the air.

Emily.

As butterflies have such large, light wings, I should have expected they would have flown with more steadiness than other insects; but on the contrary, instead of flying regularly straight forward, they jump up and down, and turn so many ways in a minute, that my eye can hardly follow them.

Mrs. Dimsdale.

The very circumstance which you regard as an imperfection in their manner of flight, is

an

an instance of the most admirable contrivance for their preservation.

Lucy.

I think I know the reason of that. I have seen birds pursue butterflies, and when it seemed impossible to escape, a sudden turn, or jerk of the butterfly, has disappointed the bird that was flying at it.

Mrs. Dimsdale.

Your observation is just. This irregular mode of flying defends them as well from their more powerful enemies, as stings or claws would do, and perhaps with more certainty. The wings of many insects are so tender, that when at rest they are folded up, and covered with strong horny cases; others, though as transparent as gauze, are strong and wiry. The variety is great, as in the other parts of insects, and has served the celebrated Linnæus to divide the whole tribe into seven orders, according to their wings. I shall not burthen your memories at present with the Latin names of the orders, but only point out the distinctions of each in plain English,

which

which I desire you will learn perfectly. The first order are known by having horny cases to their wings, of which the different species of beetles will afford you an example. Those of the second order have cases to their wings like vellum: grasshoppers and crickets are of this kind. The third order have four tiled or feathered wings. I need not tell you that the beautiful race of butterflies and moths are examples of this order. The fourth order is marked by four net-work wings and no sting.

Emily.

The dragon fly is one of this kind.

Mrs. Dimsdale.

The fifth order have likewise four net-work wings.

Lucy.

Bees, wasps, and hornets, answer to this description.

Mrs. Dimsdale.

The sixth order are distinguished by two wings and two poisers. I give you the common fly as an example. The seventh and last order

order have no wings: I leave you to find out some instances of this sort.

Emily.

There are many kinds of creeping insects without wings. I believe fleas have no wings, though they jump so nimbly.

Lucy.

Spiders have no wings, nor wood-lice, nor harvest-men. I cannot recollect any more at present; but I will observe and tell you, when I find an insect without wings.

Mrs. Dimsdale.

That is the sure way to acquire knowledge. Without attentive observation, books and instruction are of little avail to enrich the mind, though with it they are admirable assistants.

Emily.

Do all insects undergo changes, like the silkworm?

Mrs. Dimsdale.

By far the greater number suffer some change, but not all. The parent insect lays its eggs, which seldom produce a creature

like the mother; the larva, or first state, is generally a worm, maggot, or caterpillar; which is moist, softer, and larger, than the egg, and eats voraciously, if it meets with agreeable food. Here nature displays as great a variety as in the perfect insects: form, colour, habits, vary according to the species to which the larva belongs. The next state is the chrysalis, or pupa, sometimes covered with a web, sometimes not. In the third state, the insect acquires its perfect form, resembles its parent, and is mostly furnished with wings; and as soon as it is set free from its confinement, soars into the air. The silkworms you kept last summer, must have given you a complete idea of these transformations: the eggs were not larger than a pin's head; they were of a pale yellow when they were first laid, but turned black at the time they were ready to hatch. The worm, you remember, at first was very small, and black, or nearly so; but by degrees grew as large as one of your fingers, and changed its skin three times, gradually growing of a lighter

lighter hue, till it became of a pearly white, and almost transparent: at length, with joy you perceived a fine silk issue out of its mouth, with which the silkworm formed itself a covering, like an oval ball of yellow silk, without any appearance of containing a living creature; but when the silk was wound off, you found a dark brown chrysalis, something like a bean, but on nice examination, the form of the body, head, and wings folded close to the body of the future moth, were easy to be perceived. After a little time there appeared an opening at one end of this brown shell or skin, and out peeped the head of a pretty white moth, which presently disengaged itself, and after laying its eggs, died. This may serve for a history of the transformations of insects in general, with many variations as to particular circumstances.

Lucy.

I remember all this perfectly. The worm is the larva; the second state is called chrysalis, aurelia, or pupa; and the third is a fly, or moth.

Mrs. Dimsdale.

You have an excellent memory.

Emily.

Insects can feel no affection for their young, because they are creatures so different from themselves.

Mrs. Dimsdale.

The Great Creator has endowed them with instincts that are sufficient for the preservation of their offspring. Every insect, however minute, seeks a proper place for the nourishment and support of the young larva, where she may deposit her eggs: some lay their eggs in the water; others in flesh; and vast numbers choose different plants and trees, that the brood may feast on the fruit or leaves. Many require a greater degree of warmth, and they generally contrive to deposit their eggs amongst the feathers of birds, the hair of beasts, the scales of fishes; and some, in the nose, flesh, and bowels of man, and other creatures. Many kinds shelter their future progeny in nests, stored with food against they want it. Some bury them in the earth; others

others in wood; and some, still more ingenious, form cells of wax.

Lucy.

Oh, you mean bees and wasps.

Emily.

What a multitude of eggs is laid by one butterfly! If they all hatch, and each lay as many as their parent, the increase must be so prodigious, that I am surprised the world is not overrun with them.

Mrs. Dimsdale.

Great inconvenience would follow from the vast increase of insects, were there not means appointed for diminishing their numbers. Birds feed upon them in every state: I have read, that a pair of sparrows, having young ones, will destroy three thousand caterpillars in a week. Fish also prey upon the larva of many kinds; and some species are very destructive to those of a different race. Thus Providence wisely restrains the increase of the different kinds of animals within proper limits, and keeps them in a beautiful proportion that is beneficial to the whole.

Emily.

But I suppose that insects are useful in other respects, than merely supplying food to other creatures. Bees, I know, collect honey and wax; and the silk of the silkworm is made into a variety of useful things; but I do not recollect any other insect that is useful to man.

Mrs. Dimsdale.

A great many of them are applied to useful purposes; and the curious habits and structure of all afford a most instructive lesson in the wonders of creation, and lead us to see the hand of a Deity in the most minute of his works. Some insects are used in dyeing. Cochineal is an insect that produces the most admired scarlet: galls are the nests of insects: hog-lice are used as medicine: blister-plasters are made with an insect called the Spanish-fly: the larva of gnats purify stinking water: the larva of many beetles consume the gross parts of dung, and so reduce it to a state in which it is better adapted to improve the land. Some anatomists, who have wanted to clear the minuter

nuter parts of bodies from the flesh, after having filled the fine vessels with wax, have buried the parts they wished to dissect in an ant-hill, and the ants have presently cleared it with a nicety that no knife could effect: the larva of flies might be employed in the same manner with success. We will close our conversation with some elegant lines on the subject of insects, written by Mrs. Barbauld.

Observe the insect race, ordain'd to keep
The lazy sabbath of a half-year's sleep.
Entomb'd beneath the filmy web they lie,
And wait the influence of a kinder sky.
When vernal sun-beams pierce their dark retreat,
The heaving tomb distends with vital heat;
The full-form'd brood, impatient of their cell,
Start from their trance, and burst their silken shell:
Trembling awhile they stand, and scarcely dare
To launch at once upon the untried air.
At length assur'd, they catch the fav'ring gale,
And leave their sordid spoils, and high in ether sail.
Lo! the bright train their radiant wings unfold,
With silver fring'd, and freckled o'er with gold.
On the gay bosom of some fragrant flower,
They, idly flutt'ring, live their little hour;

Their

Their life all pleasure, and their task all play,
All spring their age, and sunshine all their day.
Not so the child of sorrow, wretched man,
His course with toil concludes, with pain began:
That his high destiny he might discern,
And in misfortune's school this lesson learn,—
Pleasure's the portion of the inferior kind;
But glory, virtue, Heaven for man design'd.
What atom forms of insect life appear!
And who can follow nature's pencil here?
Their wings with azure, green, and purple gloss'd,
Studded with colour'd eyes, with gems emboss'd:
Inlaid with pearl, and mark'd with various stains
Of lively crimson thro' their dusky veins.
Some shoot like living stars athwart the night,
And scatter from their wings a vivid light,
To guide the Indian to his tawny loves,
As through the woods with cautious step he moves.
See the proud giant of the beetle race,
What shining arms his polish'd limbs enchace!
Like some stern warrior, formidably bright,
His steelly sides reflect a glorious light:
On his large forehead spreading horns he wears,
And high in air the branching antlers bears:
O'er many an inch extends his wide domain,
And his rich treasury swells with hoarded grain.

DIALOGUE

DIALOGUE II.

INSTINCT.

MRS. DIMSDALE, EMILY, AND LUCY.

Lucy.

I HAVE thought of nothing all day but the animals we saw yesterday at Exeter 'Change. The lions, the tigers, and the elephants, are noble, majestic creatures; but the apes and monkeys entertained me the most: they are so like little men, that I do believe they would speak if they were brought up tame, and properly instructed.

Mrs. Dimsdale.

Some authors have ranked them next to man in the scale of animals, on account of their resemblance to him in form, and the capacity of walking upright, with some other habits for which they are remarkable; such as making a sort of hut for shelter from the weather;

weather; using stones and clubs by way of defence; covering their dead with leaves; and, on some occasions, showing marks of modesty, and strong attachment to individuals of their own species; but you are mistaken in supposing that they are capable of being taught to articulate; they are defective in the organs necessary for that purpose, therefore no instruction could ever bestow upon them the power of speech, which is a privilege peculiar to man, if we except the parrot, magpie, starling, bullfinch, and some other birds, which have been taught to speak a few words, or to whistle the notes of a tune.

Lucy.

When I was staying with Mrs. Clark, she had a monkey, which she used to call Jocko: he was the most entertaining creature I ever saw. He would offer his hand to the visitors who came to see us, would sit down to table, unfold his napkin, wipe his lips, eat his meat with a spoon or a fork, pour the liquor that was given him into a glass, and bow to the company

company like a gentleman. He would watch the time of going to tea, and bring a cup and saucer for himself, put in a lump of sugar, and then wait, after the tea was poured out, till it was cool, before he drank it. Besides all this, he played a hundred more comical tricks, that convinced me he had reason, though he could not speak.

Mrs. Dimsdale.

Not quite so fast, Lucy; perhaps you attribute those actions to reason which are only the effect of imitation. There are many animals that are equal, if not superior, in sagacity, to the monkey, in a wild state.

Emily.

I am surprised to hear that; pray what creature is there that could behave so prettily, at table, as Mrs. Clark's Jocko?

Mrs. Dimsdale.

The tricks he performed were merely the effects of mimickry, a talent in which monkeys excel; they soon learn to imitate the actions of those who are familiar with them, as a parrot learns the particular sentences which he hears

hears often repeated; but neither the one nor the other acts from the impulse of its own mind, or feels a motive for what it does. The sagacity of the beaver, who has no example to copy, in cutting down trees, and preparing them for the different parts of his curious habitation, approaches nearer to reason than any thing Lucy has related of Jocko. What, but a principle very nearly resembling the reasoning faculty, can instruct this provident animal (after having chosen those trees which stand on an eminence, declining towards a stream, that the labour of conveying them thither may be rendered more easy,) to gnaw them asunder in such a manner as that they should fall towards the water, in order to shorten the way he has to drag them? The same capacity of reflection seems to influence him in raising dams across a stream, to confine the water for his accommodation.

Lucy.

But still you must allow that monkeys are very sagacious, for Mrs. Clark told me, that many species of the monkey tribe live together

in

in society; and when a party of them goes out to plunder a garden, appoint a watchman, to sit on a high tree, to observe and give notice to the rest, if any thing approaches to disturb them.

Mrs. Dimsdale.

Most, if not all animals that live in herds, use the same precaution, to secure them against the sudden attack of an enemy whilst they are feeding, and even punish those sentinels that neglect to give a timely alarm. The next time you see the crows feeding in Farmer Green's ploughed field, you may probably discover the watchmen, perched upon some of the neighbouring trees.

Emily.

I hope I shall find them out, for I can hardly believe that birds have so much sense.

Mrs Dimsdale.

I have already remarked that this vigilance is common to most animals that live together in numbers, and is therefore no extraordinary proof of sagacity, or sense, as you call

it. The arts used by different creatures in the construction of their habitations, in rearing and providing for their young, attacking their prey, avoiding the snares of their enemies, and securing themselves from the change of seasons, are truly wonderful, and afford an inexhaustible fund of entertainment to the inquisitive mind: but they are common to the whole species, and appear to arise from an irresistible propensity, (such as we feel for eating when we are hungry, or sleeping when we are drowsy,) implanted in their nature, for the preservation of their kind, by the Great Creator. The instances of extraordinary sagacity, resembling reason, are shown when an animal deviates from its usual habits, to accommodate itself to circumstances, of which many examples have been related by persons of the most undoubted veracity.

Emily.

I wish you would tell us of some of them.

Mrs. Dimsdale.

A pleasing one occurs to my recollection, that

that happened in this village a few years ago. A pair of fly-catchers having made an unfortunate choice of a bare bough of the large vine, that grows on the south side of the vicarage, for placing their nest, were sadly distressed before the brood were half fledged, by the scorching rays of the sun, reflecting with such violence from the wall, (the season being unusually hot,) that the young ones were ready to perish. In this dilemma, affection prompted the parent birds to hover over the nest by turns, during the middle of the day, with expanded wings, and mouths gaping for breath, screening their young from the heat, at the hazard of their own lives.

Lucy.

Pretty creatures! I should have been delighted to have watched them. Pray tell us some more stories of the same kind.

Mrs. Dimsdale.

A large dog that belonged to an inn yard was once lying asleep, when he was teased repeatedly by a little dog, who challenged him to fight: for some time he suffered these

provocations, without chastising them as they deserved; but at last his patience was overcome, he roused himself, took up the little dog by the neck, and dipped him in a tub of water that stood in the yard; then composed himself quietly again, as if satisfied with having shown his power, without injuring his feeble antagonist.

Emily.

Such conduct in man would have been admired for greatness of mind.

Mrs. Dimsdale.

It resembled a hero, who disdains to crush a vanquished enemy. But to return to our subject: many birds that build nests of the usual form, in our climate, when they are found in tropical countries, where monkeys abound, are observed to change their habits, and form pendulous or hanging nests, shaped like a long purse, fixed to the end of a slender branch, to secure their young from those creatures, which are too heavy to get at them in that situation. It is probable that different de-

grees

grees of intelligence, enabling the animal to deviate from its regular instinct, according to circumstances, are enjoyed by almost every class of living creatures; since this quality has been frequently remarked amongst the domestic tribes, and those whose habits or usefulness expose them to our notice. Some advantages, indeed, these may obtain from a sort of education that they receive in their familiar intercourse with man, which may call forth and improve their powers; but it cannot give them a faculty they do not possess.

Lucy.

I did not suppose that any creature but man was capable of receiving an education.

Mrs. Dimsdale.

You did not reflect when you expressed that opinion. Can you imagine that the learned pig, the wonderful little horse, or the dancing bear, you saw at the fair last summer, performed the various exploits which amused you so much, from natural instinct?

Lucy.

No, mamma; I suppose they were taught by the man who showed them.

Mrs. Dimsdale.

Very well; then you perceive that those animals were capable of receiving instruction. In some creatures, instinct is improved by culture: the different species of hounds, and sporting dogs, undergo a severe and tedious discipline, to prepare them for the pursuits of the field. In a wild state, in which they have no food but what they procure, perhaps hunger and necessity render their senses keener; but when they are domesticated, their ferocity and eagerness require to be brought under subjection. A well-trained hound, or pointer, understands his master's signs, and is implicitly obedient to his commands Other animals acquire, by instruction, a knowledge concerning objects wholly foreign to their nature: horses, for example, are taught to draw heavy weights; to submit quietly to the rein and the whip; to move according

according to particular paces; to delight in the race and the charge to battle.

Emily.

You must not forget Captain Sachem's dog Fido, that was with him so long in the French prison. Whilst he was confined in that dismal place, he taught this faithful creature to guard every thing that belonged to him; and, the other evening, when he came to see us, he sent him back from the stile at the other end of the turnip field, to fetch his gloves, which I had hid under the carpet, on purpose to try whether he could find them; he came directly into the parlour, snuffed all around, and after searching a minute or two, found the gloves, and carried them to his master.

Mrs. Dimsdale.

Fido is a very intelligent dog, and deserves your remembrance. When you saw the bird-catcher fix his net on the common, the other morning, did you observe several linnets and goldfinches confined by a string under the net, that flirted up and down, singing melodiously,

melodiously, as if they were rejoicing in captivity?

Lucy.

Oh yes; I wondered the bird-catcher was not afraid that other birds would take warning by their fate.

Mrs. Dimsdale.

So far from it, that they are placed there on purpose to invite others into the same snare in which they were caught. Decoy-ducks, hawks, and some quadrupeds, are also trained to assist their common enemy to entrap their companions; and show that animals are not only capable of receiving instruction, by which their instincts are improved, and gaining a knowledge of things foreign to their nature, but likewise of being taught to act in a manner that seems contrary to it.

Emily.

Was it the effect of discipline, that made the old lion in the tower so fond of that little dog that used to live in his den?

Mrs.

Mrs. Dimsdale.

I suppose it proceeded rather from his change of habits, and manner of life. Beasts of prey lose much of their ferocity in a state of confinement, and become comparatively tame; which may arise partly from a want of exercise, and being full fed, without the necessity of seeking their own support, as well as from the subjection in which they are held by their keepers. When there is no natural antipathy, it is not uncommon to see a great attachment between animals of different species. A dog that belonged to a farmer with whom I was acquainted formerly, was accustomed to go out with the team, and became particularly fond of one of the horses: this horse fell sick, and while he was ill the dog never left the stable, but watched him with the tenderness of a friend. The horse died: the dog did not leave him for some time, refused his food, and showed evident marks of grief.

Lucy.

A great friendship subsists between our parrot

parrot and the tortoiseshell kitten; puss visits poll in her cage, and is feasted with the bread and milk out of her porringer.

Mrs. Dimsdale.

That is rather extraordinary, because there is a strong antipathy between cats and birds; but, I suppose, Poll, conscious of superior strength, knows there is no danger to be apprehended from her little frolicsome playfellow, who crept into her cage at first for food, and has gradually gained her confidence. Some animals are endowed with a peculiar instinctive faculty, which directs them to their food at very considerable distances; far beyond what we can attribute to sight or smell, according to the degree in which we enjoy those senses. Others are guided by some influence, wholly unknown to the wisest or most learned philosopher, that enables them to find their way home, though conveyed many miles from it, with their eyes covered. Were I to take a carrier pigeon from London to Cambridge, in a bag, and let him loose, he would return to his

his native dove-house. A gentleman once sent a brace of curious greyhounds, by sea, to Scotland, as a present to a friend; they were missed soon after their arrival, and in a little time, to their former master's surprise, were found in his kennel. The marshes that border the river Lea were, one winter, overflowed for some time; the floods suddenly dispersed, and immediately innumerable flocks of wild-fowl, which had not been before seen in the neighbourhood, crowded to the place for the sake of the frogs, toads, and other reptiles that abounded in the mud. Lucy, repeat the story to Emily, of the vulture, which I pointed out to you yesterday in the Philosophical Transactions: it will form a good sequel to those I have been relating.

Lucy.

Some gentlemen, on a hunting party, in the island of Cassimbusar, in Bengal, killed a wild hog of uncommon size, and left it on the ground near their tent. About an hour afterwards,

afterwards, the sky being perfectly clear, they discerned a dark spot at a great distance. It grew larger and larger, by degrees, as it advanced towards them, and proved to be a vulture, which flew in a direct line to the dead animal, and, alighting on it, began to feed voraciously. Within another hour it was joined by seventy more, which came from all quarters, mostly from the upper regions of the air, in which, a few minutes before, nothing could be seen.

Mrs. Dimsdale.

The sun is almost down; it is time to walk. Emily, before we set out, try to recollect the substance of our conversation.

Emily.

That all animals are taught to support and defend themselves, and their young, by instinct; that, besides this quality, some possess a capacity of acting, on particular occasions, as if from reflection; and that many improve by instruction, and change their habits in a domestic state.

Mrs.

Mrs. Dimsdale.

I am satisfied with your attention, and ready to accompany you abroad when you please.

DIALOGUE III.

GRADATION OF BEING.

Lucy.

MAMMA, whilst we were conversing yesterday, you said something about a scale of animals; pray what does that mean?

Mrs. Dimsdale.

That there are degrees, or gradations, between one creature and another, in their powers, faculties, and construction. Let us take man, as a standard of perfection amongst the creatures that inhabit our globe, and we may trace a continued chain, link by link, of beings, downwards from him to the meanest reptile. It is likewise reasonable to suppose,

that there are numberless higher orders of created beings, which ascend in gradation from him, to that Supreme Cause who is infinitely above all in every perfection.

Lucy.

Does man excel all other animals in the qualities of both mind and body?

Mrs. Dimsdale.

Reason is his peculiar prerogative, and distinguishes him from the brute creation. With respect to the bodily powers, I leave you to consider whether he is not excelled in many of them by different animals.

Emily.

The hare, the chamois goat, and the antelope, outstrip him in swiftness; and the two last in agility; for they climb the steepest crags of the highest mountains, and leap from cliff to cliff, where no human step can ever follow.

Lucy.

Dogs have a more exquisite sense of smell, or they could not trace the windings and turnings of the poor hare by her foot; nor could they

they discover the game in their different places of concealment, but from their superior power of smell.

Emily.

The vulture is supposed to see better than man; so is the lynx; and owls see in the dark, or they could not catch their prey at night.

Mrs. Dimsdale.

There are yet numberless instances in which the human species must yield to the brutes. What man can vie in strength with the elephant, and many other quadrupeds? We can neither dive with water-fowl, swim with fishes, nor fly with birds.

Lucy.

And yet, mamma, you say that man is the most perfect being that inhabits the earth.

Mrs. Dimsdale.

He has an undoubted claim to that pre-eminence; though not on account of possessing every sense and corporeal power in the most exquisite degree, but because, on the whole, he combines the greatest number of

excellent faculties, and is endowed with such superior powers of the mind, as enable him to direct the various talents of the creatures beneath him in his own service; which has given him the title of lord of the creation. He applies the scent of the dog to discover and pursue the game for his table, which he could never attain without that assistance. The strength and the swiftness of the horse render him many useful services. He is clothed with the silk of a caterpilliar, the wool of the sheep, the fur of one animal, or the hide of another: he feeds upon their flesh, and allays his thirst with their milk. None are so insignificant that they cannot be useful to him; nor are any so powerful that they can evade his authority. He is able to subdue the elephant, and the ferocious tiger; nor can the unwieldy whale, sheltered in the depths of the sea, avoid his power. Besides subjecting the animals to his will, the superiority of his nature is conspicuous, as being the only creature here to whom a capacity is given of perceiving the wisdom of God, displayed

played in the works of creation. His faculties enable him to observe how admirably each creature is formed, with powers adapted to its wants: he is able to examine the properties and structures of vegetables; to explore the various substances that lie concealed in the bowels of the earth: he can lift up his eyes to the heavens, and trace the motions of the planets, rolling at such vast distances above him: and, as his most eminent distinction, he can refer all he sees to the wisdom, goodness, and power of the Great Creator. He can praise Him for his wonderful works; and has His law graven on his heart, as the guide of life: nay, he can look forward, beyond the present state of being, to an endless existence of unfading happiness.

Lucy.

These are indeed such high marks of superiority, as place him far above the other inhabitants of the earth. The first place in the scale being given to man, I should like to know what creature has the next claim.

Mrs. Dimsdale.

It would be an impracticable task to weigh the qualities of every animal, so as to fix with exactness its rank in the scale of being. Some are eminently endowed with one sense, whilst others excel in a different faculty. We may more easily indulge our curiosity in tracing the degrees of the same quality from one animal to another. Compare the swiftness of the greyhound with the creeping motion of the sloth, whose utmost efforts, even when impelled by hunger, only enable it to remove from branch to branch of the same tree. Many are the intermediate steps between the power of flying across the vast ocean, as several birds of passage do every year, and the fixed life of an oyster, which never leaves its native rock; or the restless activity of the winged butterfly, that roves from flower to flower, and the creeping worm, that delves a passage in the earth. A little further consideration will convince us that other qualities, besides the power of motion, are bestowed in different proportions.

Emily.

Emily.

Pray point some of them out to us.

Mrs. Dimsdale.

The same principle appears in the different degrees of fertility between the nobler orders of creatures who bring forth but one, or at most two, at a birth; and that of some fishes and insects, which increase by thousands at a time. It is apparent in length of life, both in vegetables and animals: the oak, the goose, and the elephant, live a hundred years; whilst the ephemeron, and the blossom of the night ceres, exist but a few hours. In the degrees between the different magnitudes of a whale and a minnow; a condor and a humming bird; a hippopotamus and a mouse; a lofty palm-tree and the lowly moss; the largest butterfly and the minute insect, that can only be perceived by the best magnifying glasses: between the vast number of eyes possessed by a common fly, whose head is covered with them, and the entire want of sight in the blind worm. In the texture of the skin, or outward covering

of

of the body, from the delicate, fair complexion of a European lady, to the thick hide of a rhinoceros, or the impenetrable coat of mail of a crocodile. In disposition, from the sulky, malicious fierceness of the untameable hyena, to the inoffensive gentleness of the lamb; from the maternal tenderness of the watchful hen, to the negligence of the ostrich, who leaves her eggs in the sand, to be hatched by the sun; from the sociable temper of animals that live together in flocks, to the gloomy solitude of others that even beat their own offspring to a distance, as soon as they are able to provide for themselves. These instances are sufficient, though many more might be found, to show that the same beautiful proportion is visible in every part of nature.

Lucy.

I always supposed it was very easy to distinguish animals from vegetables, till I went with my aunt to see that fine collection of butterflies; when, in one of the cases, I perceived two dead leaves, as I thought, curled

up

up together; but, to my surprise, I was told that it was a species of butterfly, so exactly resembling the leaves of a plant, that it is called the walking leaf.

Emily.

If the insect you saw resembled a leaf, there are plants also that approach to the animal nature, and possess something like life and instinct. I happened to touch one of these, called the sensitive plant, the last time I was in the green-house, and the branches near my hand shrunk from it, and the leaves curled as if they were afraid of me; but as soon as I went to a distance, they recovered, and looked the same as before. After repeating the experiment, I called to the gardener, to come and see what appeared to me so wonderful; but he only smiled at my ignorance, and told me there were other plants that possessed still more extraordinary powers, and immediately showed me one, called Venus's fly-trap*, that catches the flies that attempt

* Dionæa Muscipula.

to

to steal its honey, as if aware of the injury it would receive from them.

Lucy.

I do not understand how a flower can catch flies.

Emily.

When an unfortunate fly alights upon its leaves, they close, and squeeze it to death.

Lucy.

Strange, indeed! It looks as if vegetables had the power of directing the motions of their leaves and branches.

Mrs. Dimsdale.

In some instances they appear to have a mechanical power, or inferior kind of instinct, that guides them to their own preservation. The sweet-pea turns upon its slender stem from the wind, in stormy weather, for the purpose of defending the tender parts, which render the seed fruitful. Recollect also, that the geraniums, which stood last winter in the hall, whichever way they were turned, gradually bent their branches towards

towards the window, for the sake of light, and the warmth of the sun. Plants have a faint resemblance to animals, in many respects: flowers close their blossoms at night, as animals go to sleep; and many kinds take the same precaution at the approach of rain. Trees shed their leaves, as beasts do their hair, and birds their feathers. Some plants perspire, or exude a sort of moisture. The circulation of the sap may be compared to that of the blood; and the leaves serve for lungs: the bark corresponds to the skin, and varies in the same manner in its texture; some being pliant and thin, others rough and hard. The thorns and poisonous qualities of plants, may be compared with the defensive weapons of beasts, and the stings of insects. Vegetables improve by culture: so do animals; and man especially. They both advance from a state of infancy to maturity; then grow old and die.

Emily.

I did not think there had been such a resemblance

semblance between them, they appear so very different,

Mrs. Dimsdale.

And yet, as different as their natures are, Lucy's remark is just, that it is difficult to ascertain where the animal kingdom ends, and the vegetable begins. One order of beings is united with another, by links that partake of the qualities of both. Vegetables and animals are connected together by the leaf insect, the polypus, the sea-nettle, and the tape-worm; which are of the lowest order of living creatures, and so nearly resembling vegetables, that most species of the latter, if divided, will become as many whole individuals as there are parts. The bat, the flying squirrel, and the ostrich, whose wings only assist it in running, unite beasts with birds. In like manner fishes and birds are linked by flying fish and water fowl; fishes and beasts by seals and water-rats.

Lucy.

Are not vegetables the lowest order of beings?

Mrs.

Mrs. Dimsdale.

The rank of being is estimated by the degree of intellect, sensibility, and animation. According to this rule, animals are superior to vegetables; and vegetables to minerals, which appear wholly void of that principle we call life, unless it be admitted that they grow, a point not fully determined by the learned. Our conversation this afternoon has taken a wide range, from man, the most perfect of animals, to the lifeless clod, without form or parts. The harmony and order of the whole deserves our most attentive observation, and leads us to contemplate and adore that Wisdom by which it was at first regulated, and continues to be preserved.

DIALOGUE IV.

APHIS AND ICHNEUMON.

Lucy.

MAMMA, we have been very hard at work in our garden, watering our plants, and intended to have cut a moss-rose for you, but, to our great mortification, they are all covered with a multitude of small green insects, that make them quite disagreeable.

Mrs. Dimsdale.

I am sorry to hear it. This little creature is very destructive to many kinds of trees: it is called the aphis, puceron, vine-fretter, or plant-louse. Come in to breakfast, and I will tell you some curious particulars about it.

Emily.

My plum tree, and currant and gooseberry trees, swarm with them also.

Mrs.

Mrs. Dimsdale.

It is a misfortune to which all gardeners are liable. Linnæus enumerates thirty-three species, which infest different plants and trees; but later philosophers assert, that there are more than double the number, and that two or three kinds will often live upon the same tree.

Emily.

I am afraid they will devour all our roses, and spoil our fruit. If I could but have found their nests, before they had been hatched, I would have destroyed them.

Mrs. Dimsdale.

The parent does not make a nest, but attaches her eggs, in autumn, to the twigs of trees, and as near the buds as possible, where she leaves them to be hatched in the spring.

Emily.

I suppose they are little worms, or caterpillars, at first.

Mrs. Dimsdale.

No, they resemble their mother, and what is very extraordinary, for nine generations

they are all females, who, in about ten days, instead of laying eggs, produce others, which are born alive: amongst the last progeny are found a mixture of males, who, with their males, soon die, after the latter have deposited their eggs on the twigs of trees, where, in the following summer, there will be plenty of provision for them.

Lucy.

From this it appears that the egg is a shelter for the young during the cold and rainy weather in winter, that in summer would be useless.

Emily.

I will run into the garden, if you will give me leave, and bring a few of them on a leaf.

Mrs. Dimsdale.

With all my heart. Whilst your sister is gone, Lucy, you shall bring my pocket microscope, and we will examine them in it.

Emily.

On the under part of this leaf are numbers.

Lucy.

Lucy.

I believe we have got some other insects mixed with them, for I perceive that some of these have wings, and some have none.

Mrs. Dimsdale.

That is a remarkable peculiarity belonging to the aphis, for which naturalists cannot account, as wings form no distinction between the males and females; some of both sexes being observed to have them, and others to have them not. Now let us magnify the leaf and its inhabitants together.

Lucy.

They have six small, slender legs, with feet adapted to walking; their bodies seem large and heavy, and their motion slow. The wings, of those which have any, stand upright; and there are four of them: the proboscis is very long, and bent inwards. I can see them pierce the leaf with this tube, as if they were sucking the juice out of it.

Mrs. Dimsdale.

The sap, or juice, is the nourishment they obtain from the leaves and trees which they

inhabit. In the summer, when there is a flow of sap-juice, this pernicious insect, in innumerable millions, pierces the sap vessels round the new shoots, or the arteries which lie on the surfaces of the under part of the leaves; and thus satiate their appetite with such avidity, as to part with much of this fluid in nearly the same state in which they drank it: for that moisture which often appears on the leaves of trees, called honey-dew, is supposed to be dropped by the aphis, from two small protuberances, near the end of the tail, something like horns. It is the piercing of the sap-vessels, by these diminutive ravagers, that causes the curling up of the leaves of nectarine and peach trees, and the warty appearance of other leaves, that is so frequent in some seasons.

Emily.

Do they undergo no transformations, like the caterpillar and silk-worm.

Mrs. Dimsdale.

Before the females, that have been hatched from the little black eggs laid in autumn, become

come parents, they cast off their skins several times, and then produce a very numerous living progeny, who, in their turn, bring forth a large number of young; so that from one egg only, it has been calculated that countless millions proceed.

Emily.

What must then be the produce of millions of eggs? My flowers and plants, that I love so dearly, will surely be destroyed.

Mrs. Dimsdale.

Suppose we make war upon them, by placing an army of their natural enemies upon the leaves that are infested by them.

Emily.

But I do not know their enemies, nor where to find them.

Mrs. Dimsdale.

The larva of an insect called the plant-louse-lion, devours them voraciously, as well as some other insects. I believe there is one or two of them on the leaves you brought in: we will examine them carefully again; perhaps we shall see the method used by this creature

creature in taking his prey. Do you not perceive a small grub; he is like the sloth, he does not ramble about, while he has food around him; he only lifts up his head, and strikes it down again, extending his neck in various directions, as if he were blind: by doing so continually, he perceives the first aphis that comes near him, which he immediately seizes by the back, lifts it up, and poises it in the air, as if to prevent it from the possibility of setting itself free by its struggles against the surface of the leaf, or that it may fall more readily into his mouth. In this position he holds it, while he pierces it, and sucks the juice out of the body; which having done, he drops the skin, licks his lips round with his little black tongue, draws in his head, and drops it down; then rests quietly, till his appetite impels him to repeat the same course as before. These larvæ destroy vast numbers of the aphis; and it is certainly a wise regulation of Providence, that the excessive multitudes of one animal should supply food for a different species, whose voraciousness

ciousness is proportioned to the necessity of keeping the number of its prey within certain limits. Did not several insects prey upon the aphis, its multiplication is so prodigious, and its ravages on the leaves of plants so injurious, it might, possibly, in time, destroy all vegetation, and finally deprive mankind of food.

Emily.

What other insects feed upon it?

Mrs. Dimsdale.

So many, both in the worm and fly state, that I cannot undertake to enumerate them; but the method used by a very small, black ichneumon fly, to execute its purpose, is so singular, it deserves to be mentioned. This creature has a slender body, and long antennæ; it darts its pointed tail into the bodies of the plant lice, and deposits one egg in each of those it pierces in this manner. In time, this egg produces a worm, that feeds upon the poor insect which has served it for a nest, till it attains its full growth, when it generally changes to the same kind of fly as its

its parent; though sometimes it is prevented from attaining its perfect state by another sort of small black fly, who avenges the aphis, by inserting its egg in the worm of the inchneumon within it, where it hatches, and changes to its own likeness.

Lucy.

This is most extraordinary. Are there any other instances of one creature hatching its young in the body of another?

Mrs. Dimsdale.

The whole tribe of ichneumons, of which there is a prodigious number of species, have that propensity; and render an essential service to mankind, by destroying a vast number of caterpillars and insects, that would otherwise increase to a degree which would endanger the whole produce of gardens and fields.

Lucy.

Pray tell us what kind of creatures these ichneumons are.

Mrs. Dimsdale.

They are flies, and, as I have already said, there

there are a vast many species of them. The tribe is known by having a mouth armed with jaws without any tongue; antennæ that contain more than thirty joints, which enable them to bend with great facility; and the abdomen, or lower belly, joined to the stomach by a small pedicle, or stalk: the tail is armed with a sting, which is enclosed in a double-valved tapering sheath. One distinguishing and striking character, by which you may readily know them, is the almost continual agitation of their antennæ, which are scarcely ever still. They receive their name, from the resemblance of their habits of destruction to that of the ichneumon, or mangouste, that destroys the crocodile. One of their most curious appendages, which has fitted them for their peculiar mode of providing for their young, is a sort of whimble, visible in some species, but not discoverable in others, placed at the end of the body of the females, which, though so fine, is able to penetrate through mortar, or plaster. The whimble is of an admirable structure, and consists

consists of three pieces: two side pieces hollowed out into a gutter, which serve as a sheath to a compact, solid, jagged stem, along which runs a groove that conveys the egg from the animal, who supports the whimble with its hinder leg, lest it should break, and by a variety of movements, dexterously deposits its eggs in those substances best adapted to its preservation.

Emily.

Cannot you show us one of these whimbles.

Mrs. Dimsdale.

It is the most easily seen in the long whimbled fly, one of which we will search for, by and by, in the garden. The young of this fly feeds on the larva of wasps, or mason bees; for it no sooner espies one of the nests of those insects, but it fixes on it with its whimble, and bores through the mortar with which it is built. It presently penetrates the side, and deposits its egg in safety. Some fasten their eggs, with a sort of glue, upon caterpillars; others pierce through the caterpillars'

pillars' eggs, though very hard, and lay their own withinside them. When the larva of the ichneumon is hatched, its head is so situated that it pierces the caterpillar, and penetrates to its very entrails. But what is most wonderful, is, that though these larvæ suck out the nutritious juices of the poor caterpillar, they do not destroy its vitals, for the creature appears healthy, and sometimes transforms itself to a chrysalis. I have seen those caterpillars fixed upon trees, as if they were sitting upon their eggs; and have afterwards discovered that the larvæ, which were hatched within their bodies, have spun their threads, with which, as with cords, the caterpillars have been fastened down, and so miserably perished.

Lucy.

I shall hunt over all the trees in the garden, till I find a caterpillar with an ichneumon in his body.

Mrs. Dimsdale.

They do not only attack caterpillars, but plant-lice, the larvæ of the curculiones, and

spiders' eggs. If you search upon your rose-trees, you will probably find carcases of the aphis void of motion, that have been the habitation of a small larva, that has eaten its entrails, and has been afterwards transformed under the shelter of its skin; having contrived to provide for itself a small circular outlet, by which it has got free from its prison, and sallied forth into the air. Some of these invaders are so bold, they will attack spiders, run them through with their sting, tear them to pieces, and thus avenge the whole nation of flies of so formidable a foe.—We will now retire into the study, and attend to your lessons; when they are finished, we will go in search of the ichneumon, that you may see a living instance of what I have related. Those who desire to become acquainted with the beauties and wonders of creation, must acquire a habit of patient and attentive observation; for experience is the surest guide to knowledge, and the idle, who rely wholly upon the information of others, are always liable to receive,

as

as truth, the misrepresentations of error and falsehood.

DIALOGUE V.

SOLAR MICROSCOPE.

Mrs. Dimsdale.

My dear children, as you appeared so well pleased, yesterday, with examining the microscope, I have provided entertainment for you, to-day, from one of a different construction, which will magnify the objects it displays to a far greater size. We will go into the study, where I have ordered it to be fixed.

Emily.

Mamma, you have a mind to impose upon us; it is a magic lantern you are going to show us.

Mrs. Dimsdale.

My dear, I never deceive you, in jest or

earnest. This is called a solar microscope, because it acts by the light of the sun, which is reflected against the white sheet on the wall, in the same manner as the light of the lamp is in the magic lantern.

Lucy.

Shall we see Punch and his wife, and all those comical figures that diverted us so much, when we saw the magic lantern at the fair.

Mrs. Dimsdale.

You are now too old to be amused with such nonsense. The objects I shall show you are much better worthy your attention, as they will convince you that every part of creation is formed with the most curious and beautiful nicety, adapted in the wisest manner to the purpose for which it was designed; and that it is the work of an infinitely intelligent Being, who has provided for the enjoyment and welfare of the meanest of his creatures. We will make the room quite dark, that the light reflected through the tube of the microscope may appear stronger

on

on the objects we wish to examine: now, look towards the sheet, and tell me what you see.

Lucy.

I see the shadow of a very large circle of the finest lace, and of a most elegant pattern.

Emily.

You have changed that for another, still more beautiful.

Lucy.

Pray, mamma, why do you show us these patterns of lace, and so many of them, all different from each other?

Mrs. Dimsdale.

You may well mistake them for lace: it would, indeed, be difficult for you to guess what they really are; it is therefore necessary for me to explain it. These circles of exquisitely varied and elegant net-work are thin slices of the branches and roots of different trees and plants, cut crosswise, to show the forms of the pores, through which the sap and the juices circulate. I have a great variety of these to show you; when you are

satisfied with them, we will choose something of a different sort.

Emily.

They are extremely beautiful, but I long for novelty.

Mrs. Dimsdale.

My next exhibition shall be a selection of leaves of plants, stripped of their skin, which will discover their fibres only.

Lucy.

They, also, resemble fine lace; but the pattern is very different from the fibres of wood.

Mrs. Dimsdale.

Behold the wing of an earwig!

Lucy.

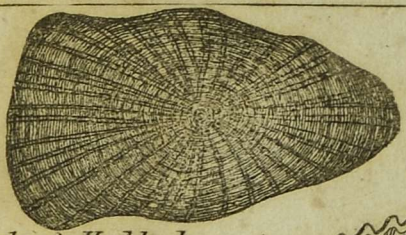
What a monstrous size! neither did I know that earwigs had wings.

Mrs. Dimsdale.

Their wings are concealed in many folds, under a horny kind of case, which prevented you from observing them.

Lucy.

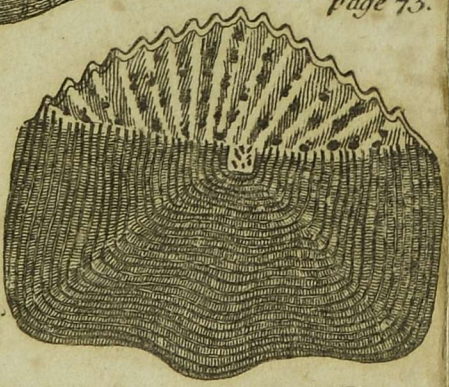
I have such a dread of their getting into my



A Scale of a Haddock Magnified.

A Scale of a Haddock.

page 73.



Scale of a Sea Perch Magnified.

Scale of a Sea Perch.

An Earwigs Wing.

page 70.

An Earwigs Wing Magnified.

The powers of the Microscope in magnifying objects shewn by comparing the same subject of its natural size, with its appearance in the Microscope.

my ear, or biting me, that I always go away from the place where they are.

Mrs. Dimsdale.

There is no occasion for such fears. The ferceps at the end of the tail, though it has a formidable appearance, has but little strength to hurt any thing, except flowers, to which these insects are very injurious, especially carnations. But to return to the microscope. Here is the wing of a moth: observe the strong muscles, or ribs, that are formed to support it, and give the creature the power of resisting the air, when it uses them for sails.

Emily.

They look as large as bones.

Mrs. Dimsdale.

Now you shall see the feathers that cover a butterfly's wing, and which, to the naked eye, appear like a soft down, displaying the most beautiful colours.

Emily.

What magnificent plumage these little creatures

creatures wear! It far exceeds the richest silks and velvets.

Mrs. Dimsdale.

Other parts of insects are equally curious, being wisely adapted to the wants of the animal. Here is the proboscis of a bee, which is a sort of long tongue, that the insect can stretch out of a case that encloses it, whenever he wishes to suck the honey, or juices, from flowers, as you must have often observed, on a summer's day.

Lucy.

Oh, yes, I love to watch the bees thrusting their long mouths into the bottom of the deepest flowers.

Emily.

But what is this? it looks like a sword drawn out of the scabbard.

Mrs. Dimsdale.

It is the sting, which, when drawn in, is guarded by a horny sheath, as you may observe: above it is the bag of poison, conveyed through the sting into the wound, and is the principal cause of the pain: at the end is a bearded

bearded shaft, divided into two points, which pierce the flesh alternately, and often prevent the sting from returning. If you have examined it sufficiently, I will change it for something not less surprising.

Lucy.

I cannot guess what this is; it seems like a regular piece of net-work, each mesh having six sides.

Mrs. Dimsdale.

This is part of the reticulated eye of a dragon-fly, which I once described to you. I suppose you recollect that every one of the meshes, as you call them, is a separate eye, or sight; and that which we call the eye, is a collection of two thousand eyes, placed in a cluster.

Emily.

This is a net-work of small squares; to what creature does it belong?

Mrs. Dimsdale.

This is the eye of a lobster. Crabs, and many insects, are furnished with eyes of the same

same kind. We will now amuse ourselves with the scales of fishes.

Emily.

They appear almost as large as a shield, and of such a variety of shapes, each species of fish, I suppose, having those of a peculiar form.

Mrs. Dimsdale.

They not only vary in different fishes, but in the several parts of the same fish; and many of them appear carved with elegant flutings, and embossed work. I shall next present you with a city, inhabited by a living race.

Emily.

It appears to me like rock-work, moved by something beneath it.

Lucy.

There is a creature as big as a tortoise, crept out of these rocks; it has eight legs, and two great horns.

Emily.

Ah, there are several of them, running different ways.

Mrs.

Mrs. Dimsdale.

The rocks are morsels of the dust of pearl barley; and these huge animals, that trot about so briskly, are only mites, which feed upon it.

Lucy.

To what a surprising size they are magnified!

Mrs. Dimsdale.

The crystallization of salts was first discovered by the microscope, and affords a great variety of beautiful objects to the curious admirer of nature. I shall show some specimens of them, which will please you by their motions, and the elegance of their forms.

Emily.

Explain first to us what you mean by crystallization.

Mrs. Dimsdale.

After different substances, especially salts, have been dissolved in certain liquids, the particles of which they are composed begin to unite again, and form themselves into particular

ticular shapes, which are called crystals: many of them are so small they cannot be discerned exactly without being magnified; but the crystals of rock salt are very large; and you must have often seen them at table. The same substance always produces crystals of the same shape; from this circumstance adulteration may be detected, by the mixture of crystals of different kinds. You will understand me better when you have seen the operation. Here is a drop of saltpetre dissolved: it appears like a circle of several feet wide. You may now perceive a motion round the edges, something like running water.

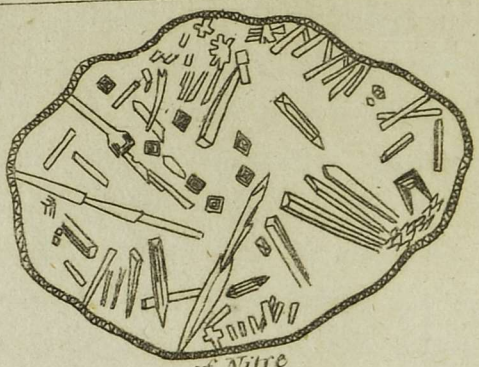
Lucy.

Yes; it moves in all parts, and begins to dart into shapes, almost like needles. It is extremely pretty; I could look at it for an hour, without being tired.

Mrs. Dimsdale.

I will exchange it for a solution of camphor.

Emily.



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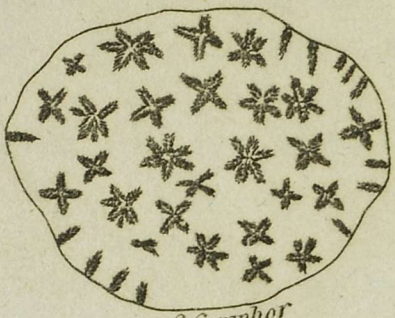


of Camphor

of Manna

The appearances of Salts, when forming their crystals in a drop of liquid, as they appear [illegible] Microscope.

Emily.

Oh, how beautiful! It has formed itself into crystals shaped like stars.

Mrs. Dimsdale.

I shall next present you with the salt of manna.

Lucy.

How it shoots from points at the very edge of the drop, like a fringe: these lines seem to attract each other into clusters; and now they resemble the branches of a sea-weed.

Emily.

I admire these solutions the most of any thing you have shown us: it is very amusing to see them first begin to move gently from the edge, then dart into different forms, then unite in clusters, and at last fix all into one regular shape.

Mrs. Dimsdale.

The curious phænomena that nature presents, are one of the most rational entertainments we can enjoy; they are easy to be procured, always at hand, and, to a certain de-

gree, lie within the reach of every creature, who has the perfect use of his senses, and is capable of attention. Who can walk abroad of a morning, and not be charmed with the glorious sun, the innumerable beauties of vegetation, trees, plants, herbs, flowers, and fruits. Animals are still more interesting, whether we contemplate their forms, habits, stratagems for defence, or for procuring food. The evening presents new wonders: for who can behold the vast firmament, studded with brilliant suns, that give light to innumerable distant worlds, peopled with an inconceivable multitude of inhabitants, and not feel his heart glow with adoration to the Supreme Creator and Preserver of the whole universe? Whichever way we turn our eyes, something striking and curious appears: the earth, the air, the sea, teem with wonders. Nor are beauty, order, symmetry, and grace, confined to the surface of natural objects: the interior parts, as we have seen this afternoon, display the same wisdom and contrivance.

trivance.--But you have applied long enough for the present. Go and divert yourselves abroad.

DIALOGUE VI.

ANIMALCULES.

Mrs. Dimsdale.

I PROMISED to reward you, by some indulgence, whenever you should have acquired the habit of rising as soon as you are called, and dressing yourselves neatly in a quarter of an hour. It is now high time to perform this engagement, as, for the last fortnight, I have not marked down one morning in which you have broken my rule. I have therefore procured another microscope, with great powers, and intend to amuse you with some of the wonders of the minutest parts of the creation that we are capable of observing; for I by no means dare to assert that the

insects I shall show you are the smallest creatures that exist. The invention of man has not yet contrived glasses that comprehend either the *vast* or the *little* of nature. By every improved telescope, new stars are discovered; and as the powers of the microscope are increased, more minute races of living creatures become perceptible. Here let us contemplate the infinite power of the Great Creator, that is as much displayed in the formation of the smallest of these animalcules, imperceptible to the keenest sight, without the assistance of the highest magnifiers, as it is in the structure of a world; for nothing short of Omnipotence can effect either the one or the other. Let us next adore his goodness, who delights to communicate life and happiness to an infinite number of beings, of different ranks; for these tiny creatures have their enjoyments, as you will perceive. His wisdom is conspicuous in every part of his works, whether we stretch our understanding to its utmost limit, to comprehend the vast magnitudes and distances

tances of the stars, or whether we turn our attention to the other extreme of creation, and observe the forms, motions, and habits, of the most minute creatures.

Lucy.

You could not have rewarded us more agreeably.

Emily.

But when will you show us these wonderful little creatures?

Mrs. Dimsdale.

Directly.—Walk into the study: there you will see the apparatus prepared for my exhibition; and I will follow you in a few minutes.

Emily and Lucy examine the microscope with curiosity.

Emily.

We have looked through the glasses, mamma, but can see nothing.

Mrs. Dimsdale.

You should have patiently waited for me; I am not pleased with you for meddling with the microscope.

Lucy.

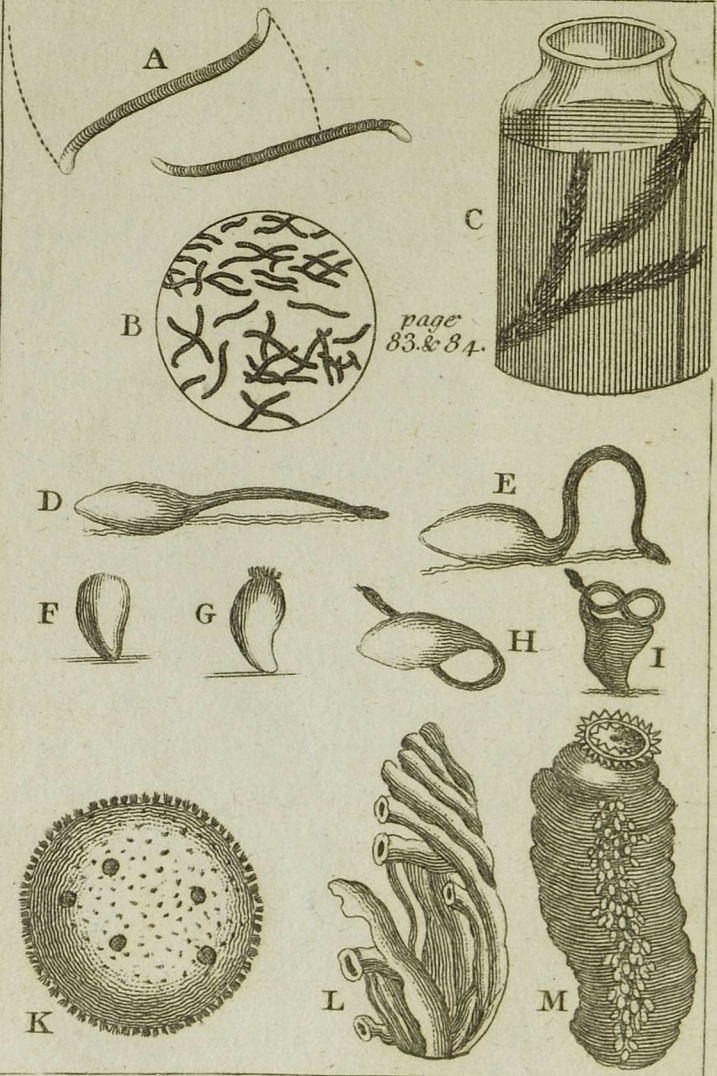
We are sorry we have done wrong; forgive us, and we will not do so in future.

Mrs. Dimsdale.

Fix your attention on the subject before you, and I shall pass over your fault this time. We have good grounds to believe that every part of nature teems with living creatures; as the experiments of many philosophers prove, that they exist where we should not expect to find them. Though it is probable that the earth and air are equally crowded with these minute inhabitants, as the water; yet liquids are so much more favourable, from their transparency, for showing their form and motions, that I have provided some water, taken from a muddy ditch, for the purpose of examining its contents. I will put a drop of this water into the microscope: now, Lucy, look through and tell me what you see.

Lucy.

I perceive something like a small, slender worm, composed of rings, with the ends bent towards



A.B.C. *Hair like Insects.*—D.E.F.G.H.I. *Proteus Insects.*—K. *Globe Insect.*—L. *Pipe = Insects.*—M. *a single Pipe magnified.*

towards each other: it is green, and quite transparent. Ah! it moves. It rests upon one end, and then turns itself round on the other; but I do not know which is the head or the tail, because I cannot perceive its eyes.

Mrs. Dimsdale.

It is called the hair-like insect, on account of its slender shape As large as it may appear to you through this magnifier, it is in reality so small, that millions of them might lie on a square inch. Notwithstanding their extreme minuteness, they seem to love the society of each other. Observe a multitude of them in this jar of water: they form themselves into a regular body, and ascend to the top, where, from green, their colour changes to a beautiful sky blue. Now they are changing their position, and descending together in a large company, in the form of a rope. But what will they do? there is another army, consisting of many millions, that are rising from the bottom of the jar: let us watch their contrivance to pass

pass each other; but as their motion is very slow, it will require some patience. Well, this is surprising, and shows that they possess sagacity, and a voluntary power of moving in any direction that suits their circumstances. The party from below has divided to the right and left, and politely made way for those who are travelling downwards to pass between them. This insect was first discovered in a ditch of one hundred yards long, and nine broad, at Norwich; the bottom of which was covered a foot thick with a blackish green mud, chiefly composed of them: the prodigious numbers here alone, must exceed all calculation.

Emily.

Are there different kinds of these animalcules?

Mrs. Dimsdale.

Nature delights in variety; and in these creatures, so imperceptible to the naked eye, has displayed her powers in that respect: as many kinds are already known, and it is supposed

posed there are yet many more that have escaped observation.

Emily.

I hope you will show us one of them.

Mrs. Dimsdale.

In order to gratify your curiosity, I have provided myself with several liquids, in which different kinds are found. Observe this glass jar; there is a slimy sort of substance that sticks to the sides of it, from the stalks of the flowers that stood in the water. I will take some of this on the point of my penknife, and examine it in a drop of water; it is likely I shall find plenty of the Proteus insect in it.

Lucy.

Why is it called by that name?

Mrs. Dimsdale.

Because it has the power of changing its form continually. If you look through the microscope you will see it swimming about very nimbly; sometimes stretching its long neck straight forwards, then bending it like

that

that of a swan, then turning it round its body, and sometimes drawing it in, and thrusting out in its place something like a wheel. Here is some rain water, collected from a leaden gutter, where it has stood several days: in its sediment we shall find a most curious animalcule, called the wheel animal, or vorticella. Though this creature shows no signs of life, except when in the water, yet its vital powers are preserved for many months, when kept in a state as dry as dust. I have some of this dust, which I will put into water; at first it will appear only like a minute grain of lifeless sand, but in half an hour you may perceive a languid motion; the globule will begin to turn itself about, and lengthen by degrees, till it assumes the form and appearance of a lively maggot, and then it will put out its wheels, swimming vigorously in the water, in search of food: or perhaps it may fix itself by the tail, and work its wheels in such a manner as to attract its food within its reach.

Lucy.

Lucy.

Wheels, mamma; what do you mean by that? has the insect a machine, or a carriage, to convey it about in the water.

Mrs. Dimsdale.

There are several species of animalcules, furnished with a curious apparatus resembling wheels, which assist these insects in catching their prey. If you examine those now in the microscope, you will perceive a small circle, projecting beyond the head, resembling the balance-wheel of a watch, surrounded with teeth. The creature appears to have the power of moving this wheel at pleasure, and changing its form to an oblong. At one time the wheel appears to vibrate; at another to turn swiftly round.

Emily.

I see it very plainly. There are also many living creatures in the water, much smaller than the wheel insect, which, I suppose, serve it for food. The wheel insect is transparent; I can see something like a ring in the head, just above the mouth.

Mrs.

Mrs. Dimsdale.

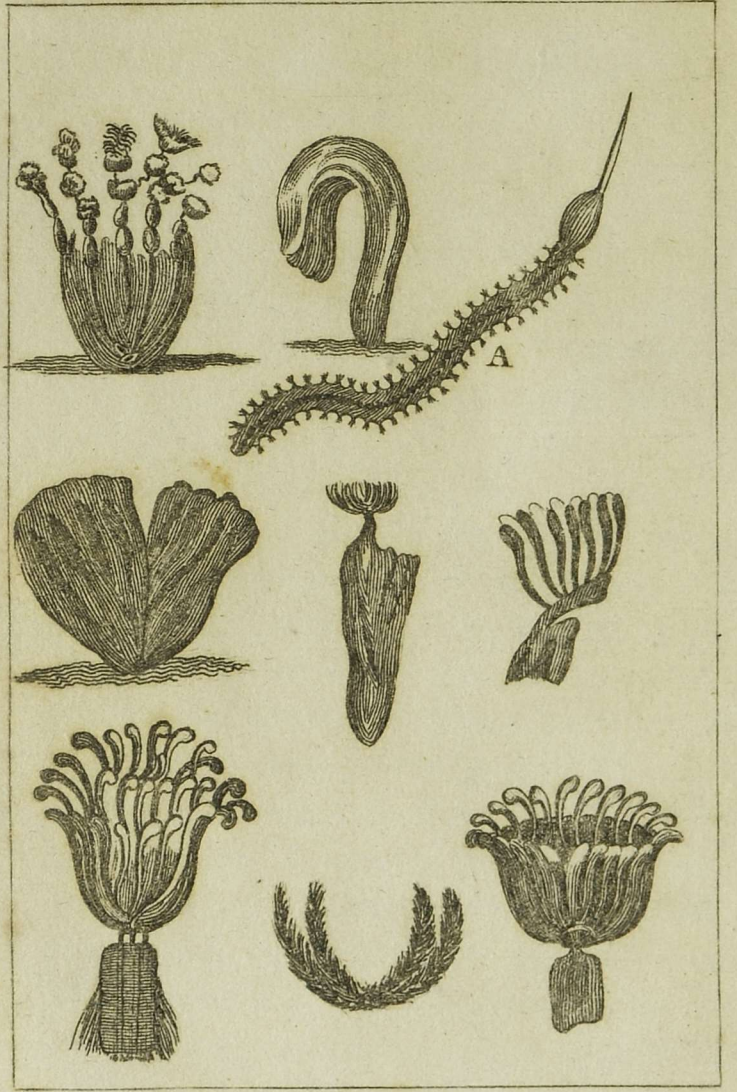
That is supposed, by some philosophers, to be the seat of the brain.

Emily.

I observe a spot in the middle of that part of the body that joins to the head, that beats like a pulse: I believe it is the heart. In the lower division of the body I can see the intestines, twisting about in a very curious manner.

Mrs. Dimsdale.

The young of this species, before its birth, is nourished on the outside of the parent, in a sort of case, somewhere near the tail: when they have arrived at the proper size to take care of themselves, the young insect breaks its covering, and puts out its head first, the old one assisting it to disengage itself. In order to effect its release, the young one sets his wheels a going, and as soon as it is free, swims away, wagging its tail like the parent. This creature is a great tormentor of the water-flea, an insect not nearly so large as the common fly. Five or six of them will fix themselves



Different appearances of the Bell-flower-animal; except A. which is a curious aquatic worm.

emselves by their tails to the shell or horns the flea, and appear to give it a great deal uneasiness, by its efforts, though fruitless, o get rid of it. Here is a glass of water with duckweed in it, which I have kept with design to show you some specimens of the bell-flower animal, or, as some term it, the plumed polype. These animalcules dwell in colonies together, in a slimy kind of case, formed of a jelly-like substance, which, when out of the water, looks merely like a little lump of slime; but when expanded in it, resembles the figure of a bell, with its mouth upwards: these bells are about half the size of a small gooseberry, and are very transparent, which makes it easy to see the motions of its inhabitants distinctly. It seems divided into several apartments, each of which contains a separate insect: the openings of these divisions are only just large enough to admit the head and a small part of the body to be thrust out beyond it; the creature never entirely leaving its case, and often withdrawing quite into it, especially as a refuge from

 danger,

danger, when alarmed by any sudden motion of the water. Besides the power of moving, possessed by each individual, the whole family united enjoys a capacity of altering the position of their habitation; nay, even of removing it from one place to another; thus, the bell sometimes is found standing upright, and at others the upper part is bent downwards. The number of these creatures that live together never exceed fifteen; therefore, when they increase beyond that, the bell divides generally from top to bottom, and forms two distinct, independent republics.

Lucy.

I should like to see one of these insects by itself.

Mrs. Dimsdale.

There is one placed in the microscope: now tell us what you observe.

Lucy.

It appears to have a great many tendrils, perhaps forty, fixed round the head, spread out in the form of a horse-shoe. These tendrils, or arms, the creature stretches out at pleasure,

pleasure, as if to make a current in the water, which brings a number of very minute animalcules to its mouth; some of them it swallows, but others it drives away by a contrary motion of the water.

Mrs. Dimsdale.

This insect has not the power of contracting its arms, like the common polype; but when it wishes to retire into its cell, it brings them close together, like the folds of a fan, by which means they are easily drawn in.

Lucy.

The one I am examining has separated them into four divisions, which are very much like plumes of feathers.

Mrs. Dimsdale.

I shall now exhibit the globe animal, so named on account of its form, which is like a round ball without any appearance of head, tail, or fins.

Emily.

Yet it moves in all directions; upwards, downwards: now it rolls over and over like

a bowl: now it spins like a top, turning itself round and round: sometimes it moves slow, and sometimes fast. It is a very amusing creature. Pray, sister, look at it.

Lucy.

It is quite transparent, except six or seven black spots; and its whole surface is set with moveable bristles.

Mrs. Dimsdale.

Probably they are the instruments that enable the creature to perform its different motions. Here is another species of these animalcules, that live together like the inhabitants of crowded towns, and are found on the coast of Norfolk, living in small tubes, or cases of sandy matter, united like pieces of coral; from which circumstance they are called the pipe insect. Each individual is a sort of worm, composed of rings, that the creature can extend or contract, according to its inclination. The head is exceedingly beautiful, and furnished with a double row of feelers, or arms, disposed in regular order; most probably for the purpose of seizing its food,

food, and conveying it to its mouth. The cases in which these animals live are formed of sand, intermixed with minute shells, and cemented together by a kind of glue, which I suppose issues from the worm for this use.

Lucy.

The more you tell us, the more I am delighted with the wonderful variety in the shape and habits of these little creatures, and the extraordinary contivances for their comfort and accommodation, according to their different natures.

Mrs. Dimsdale.

I have yet only mentioned a few of the most remarkable. Infusions of different substances, produce an almost endless variety. I will, however, show you two or three more, if you are not too much tired to attend.

Both the Children.

Pray go on; we are not in the least weary.

Mrs. Dimsdale.

I have here some paste, that has stood several days till it is now quite sour: cannot you perceive something move in it like living creatures?

Emily.

Oh, yes, mamma; pray let us see them in the microscope.

Mrs. Dimsdale.

You can now see them move about briskly. Vinegar abounds with eels something like these. Many curious experiments have been made by ingenious naturalists, by which animalcules have been found where there was no appearance of life. Ears of blighted wheat appear to be filled with a soft, white substance, like fine threads. Who would suspect this to be insects in a torpid state? but, on steeping it for several hours in water, these threads begin to move, and to convince the attentive spectator that they are living animals. The same surprising effect has been observed in potatoes, either boiled or raw, after standing some days in water.

To

To the invention of the microscope we are indebted for a knowledge of these wonderful facts; and the examinaton of many other minute parts of the creation. Some future time, perhaps, I may again gratify you with it; but we have seen enough for the present. It is proper to change your employment. We will take a walk; our afternoon's amusement will supply us with conversation by the way.

DIALOGUE VI.

SEA ANEMONES.

Lucy.

It is such a wet evening, we cannot go a walking: what amusement shall we find to pass away the time.

Mrs. Dimsdale.

None but the idle need want employment: there is always a great variety of pursuits,

pursuits, that are both useful and agreeable, for those who are disposed to fill up their leisure properly. It happens, however, fortunately for you, that I have provided an entertainment for this evening, that I hope will make some amends for the loss of your walk. Desire John to bring in the pan with the sea-insects that I ordered to be collected for us.

Emily.

What strange creatures! they are far more like flowers than insects.

Mrs. Dimsdale.

Therefore they are called sea-anemones. Look at them attentively: you will by that means be better able to judge of their form and motions.

Lucy.

They change their shape continually: some of them are like a bell with the top cut off; others resemble a little pillar, crowned with leaves: there is one encrusted in a covering of sand and shells, spurting water out of its mouth like a fountain; look,

it

A.A.A.A. *Different species of Sea Anemonies single, and in groups.*—B. *one of them divided in half to shew their inward structure.*

it has slipped out of its coat of mail, and is now as defenceless as the rest. Sometimes they appear round at the base, where they stick to the pan, and then they become oval: sometimes they stretch out the leaves that surround their mouths, and afterwards contract them close together, like the petals of an anemone.

Emily.

The variety of their colour surprises me. Their prevailing hues are purple, green, brown, and violet, in all their different shades; while some are of as rich an orange as the inside of a melon, and others as white as ivory: besides, there are others beautifully variegated with black and white, like the quills of a porcupine. How much larger some of them are than others: there are one or two that would cover the bottom of a small plate, whilst few of the others exceed the size of an oyster.

Mrs. Dimsdale.

Those are probably of a different species. I cannot tell you with certainty what number

of

of species of these animals are known; but there are several, and it is likely that more will be discovered, as future naturalists have further opportunities of investigating them.

Emily.

Those things so much like leaves, that grow round the mouth, certainly serve the creature for arms; for just this minute I saw one of them stretch out a leaf, and catch up a small muscle, that happened to be near it, and afterwards carry it to its mouth, where it was swallowed up in an instant.

Mrs. Dimsdale.

They swallow muscles whole without difficulty; and though their shells are closed, in a day or two after throw up the shells entirely empty: from this circumstance the creature would seem to be voracious, were it not known to have subsisted for a twelvemonth on the produce of the sea-water only; neither does it appear eager in the search of its prey, but rather waits patiently till chance throws it within reach of its limits, as you observed just now. Let us throw in some little bits of raw

raw meat, that we may see whether they have an inclination to eat.

Lucy.

Two of them have seized the same piece; but neither is disposed to yield it to his antagonist: they each draw it further and further into their mouths, till they will surely meet. Now the orange-coloured gentleman is almost triumphant. Unfortunate fellow! he has slipped his hold, and the grey one will carry it off.

Emily.

They have again nearly an equal hold: see, how hard they pull it. The orange-coloured one has recovered his advantage, and at last will certainly come off conqueror: he has got it entirely away; and down it goes, without ceremony.

Lucy.

The grey one is a stupid creature; though he was so eager to obtain the prize, he shows no mark of resentment or anger for his disappointment, but looks as well satisfied as if he had got it.

Mrs.

Mrs. Dimsdale.

These creatures are not endued with great sensibility of any kind, if we may judge from their habits. As far as they are known, their intellectual powers are of the lowest order, and do not extend much beyond directing them to adhere to those rocks, where they are most likely to meet with that kind of food that nature has appointed for their sustenance. Many species of them feed upon those floating transparent animals, of a white, glassy, or of a blue or purplish hue, called wandering nettles, or sea jellies, that abound in some parts of the ocean. Muscles, and crabs also, seem agreeable to them; and they will sometimes eat one of their own kind, of a different species, and after keeping it in their stomach eight or ten hours, or longer, will throw it up alive, and apparently unhurt.

Emily.

They have the power of moving from one place to another, however; for this large purple one has travelled quite across the pan, and

and is going to fix himself on the opposite side.

Mrs. Dimsdale.

Their motion is slow; but still they have the capacity of transporting themselves from one place to another, as inclination or necessity may require. Though their claims to superiority are but few, yet, in this respect they rank higher than an oyster, which is fixed to its native rock, without the power of changing its position.

Lucy.

The oyster has a full compensation in the strong shell that secures him from injury; whilst these poor, soft, defenceless creatures are exposed on all sides to wounds and accidents, from every thing that touches them.

Mrs. Dimsdale.

If they are endued neither with swiftness to escape from their enemies, nor a hard covering to resist them, a certain quality is bestowed upon them, which preserves their lives from such accidents as are fatal to most other creatures. Were a sea anemone to lose

a limb, in a contest with an antagonist, it would grow again: nay, should it even be divided in half, the parts would survive, and, in time, be furnished with a new supply of members, instead of those it had lost. The experiment is too cruel for us to try, merely to gratify a wanton curiosity; therefore we must rely upon the account given by Monsieur Dicquemar, of the effects of cutting members of them in different directions.

Emily.

Barbarous man! to torment a harmless insect in that manner.

Lucy.

But since he has done so, pray let us hear what followed.

Mrs. Dimsdale.

He relates, that having clipped off the limbs of both a purple and green anemone, they soon budded out again: he clipped them off from the same insect a second time, and in less than a month they were renewed as before:

before: he repeated the experiment a third time, with the same success.

Emily.

Would they continue to have new limbs as often as they were cut off?

Mrs. Dimsdale.

That is doubtful; but it is not unlikely, that after several reproductions, the animal would be exhausted of matter for the supply of new limbs: though he does not say that the operation appeared to have any effect upon the health and vigour of those on which he tried the experiment. Several he cut across, which, after languishing as if in a sickly state, some for weeks, others for months, revived, and put forth a new mouth and limbs, which gradually increased to perfection, when they became capable of taking food as at first. One day, after having divided a brown one, he offered some bits of muscle to the upper half; these the limbs seized, and conveyed to the mouth, which was stretched out to receive them; but as the body was wanting, they passed through

at the other end: the same anemone swallowed them again; but this time they remained within it till the next day, when they were returned by the mouth. At another time he cut one partly across, but did not divide it; the two parts presently united, and the wound, though deep, was completely healed in a few days, with very little apparent suffering to the animal. It happened once, contrary to the usual progress of the divided parts producing substitutes for those cut away, that, from an upper half, grew limbs and mouth at the other end, instead of forming a new base; so that a monstrous animal was formed, that caught its prey and fed at both ends at once.

Emily.

It seems as if it were impossible to kill them.

Mrs. Dimsdale.

It is indeed very difficult to deprive them of life. Monsieur Dicquemar exposed them to great extremes of heat and cold, without destroying

destroying their existence. He put some of them in a glass vessel, filled with salt water, over the fire; when the water became heated they seemed to feel great inconvenience, and one of them swelled and died, in consequence of the heat being too excessive: most of the rest appeared to feel no ill consequences from the experiment. Others he exposed to a keen frost, till the water in the vessel was nearly a mass of ice. The anemones appeared as if they were dead; but as soon as the ice began to melt by the fire, they showed signs of life, opened themselves, moved about, and recovered, as the water regained its usual temperament. Sea-water is this creature's natural element, and nothing seems more baneful to it than fresh water. Of whatever colour they are, they soon turn pale after being put into fresh water, and lose the power of motion; their coat becomes so flabby, that it may very easily be stripped off in shreds, and in a short time they die.

Lucy.

Their mouth and limbs are to be seen plainly, but I can perceive no eyes.

Mrs. Dimsdale.

They do not appear to have any; yet they are sensibly affected with light: were we to place a lamp, or a candle, over the pan, so that the light should shine into it, they would close up immediately, and not unfold themselves till the light was withdrawn. Though they are thus affected by a sudden impression of light, they may be incapable of distinguishing objects, unless they are furnished with organs of sight that have hitherto escaped observation. Whether sight, touch, or smell, directs them to their food, is yet unknown, and can be discovered only by a better acquaintance with them.

Emily.

Have any of their eggs ever been found?

Mrs. Dimsdale.

They do not lay eggs: but in that particular imitate the nobler orders of animals, by bringing forth their young alive: they

are

are known to have produced ten or twelve at a time. The young ones are extremely small, but appear to be completely formed, and immediately on their birth show a capacity of fixing themselves, like their parents, to the rocks which they inhabit. There is another species of them, more elegant than any of these, that I was not able to procure. They are found in oyster beds, and resemble a cluster of white or flesh-coloured feathers: out of their body and mouth proceed a number of threads, about the size of a horse-hair, which, on being examined with a microscope, appear to be composed of a prodigious number of vessels, through which some fluid was seen to circulate, but of what use these are to the animal has not yet been discovered; though it is most likely that they are the organs of some sense, as feeling, or smell, which is essential to its preservation or support. I have now told you most of the particulars I know of these creatures. It is probable that there are many other circumstances relative to them, were they more exposed to our notice, that

that would excite our admiration; yet we are sufficiently acquainted with them to acknowledge, that the same wisdom and design is apparent in the correspondence of their structure and organs with their habits and mode of life, as are visible in the other parts of the creation; so that we may say with the Psalmist, "O Lord, how manifold are Thy works! in wisdom hast Thou made them all. The earth is full of Thy riches: so is this great and wide sea, wherein are things creeping innumerable, both small and great beasts. These wait all upon thee, that Thou mayst give them their meat in due season."

DIALOGUE VIII.

METEORS.

Lucy.

WHAT a beautiful rainbow! Make haste, Emily, or it will be gone before you reach the window.

Emily.

Emily.

How grand! the arch extends from one side of the sky to the other. What fine colours! purple, blue, green, orange. Ah, it is fainter, the sun is gone in: it is almost gone.—Mamma, pray tell us what makes the rainbow appear and vanish so suddenly.

Mrs. Dimsdale.

Before I reply to your question, tell me where the rainbow is situated, with respect to the sun.

Emily.

It is directly opposite to it. Dear, how it pours: and the sun shines again quite bright; the rainbow is finer than before—the colours are charming.

Mrs. Dimsdale.

Just now, when the sun went in, you observed that the rainbow nearly vanished; but as soon as the sun shone again, the rainbow appeared as splendid as ever. Does not this lead you to suspect that the changes of the rainbow depend upon the sun.

Emily.

Emily.

Certainly; but what effect can the sun have upon the rainbow, at such a distance from it?

Mrs. Dimsdale.

It depends wholly upon the sun; were there no sun, there could be no rainbow.

Lucy.

You surprise me: I thought the rainbow had been a real coloured arch.

Mrs. Dimsdale.

The rainbow is always seen opposite to the sun, because it is formed by the refraction of the sun's rays on the drops of water falling from the clouds.

Emily.

Refraction: what is that?

Mrs. Dimsdale.

I will endeavour to explain it to you, in the plainest manner possible. The rays of light, which issue continually in all directions from the sun, pass in direct lines to the earth, till they meet with any thing to obstruct their course. If the body that interrupts

rupts their passage be solid, or opake, they are driven back, which is called reflection; and by meeting our eyes, are the cause of all objects being visible to us: but when the rays of light fall on substances that are transparent, they pass through them, not in direct lines, but are bent out of their natural direction. This bending of the rays of light is called refraction, and differs in degree according to the resistance of different bodies: thus, water refracts more than air; and glass more than water. Refraction produces many extraordinary effects upon the appearance of objects. In the present instance, the drops of water in yonder cloud refract, or bend, the rays of light that shine on them, and by that means cause the variety of colours that you so much admire.

Lucy.

I do not doubt that it is as you say; but how could any one find out that the sun shining on a cloud full of water was the cause of the rainbow?

Mrs.

Mrs. Dimsdale.

An easy experiment, that I will show you, will convince you that it was not so difficult as you imagine, to discover this to be the cause of the rainbow. Bring me the glass bowl, in which you used to keep the gold fish.

Lucy.

Mamma, here it is. I am quite impatient to see what you are going to do with it.

Mrs. Dimsdale.

Emily, fill it with water, and give me a piece of string that I may hang it up, so that the sun shall shine full upon it. Now, what do you see?

Lucy.

The side of the globe next the sun is of a full red.

Mrs. Dimsdale raises and lowers the globe alternately.

Emily.

Now it is changed to a yellow, green, blue—all the colours of the rainbow.

Mrs.

Mrs. Dimsdale.

Are you not convinced, by the effect of the sun on the globe of water, that the arch in the sky is produced by the same cause?

Lucy.

Yes; I understand it clearly.

Mrs. Dimsdale.

The different degress of refraction sometimes give false notions of the distance and size of objects. For example, if the eye is placed in a mist, things beyond the mist seem further off than they are; consequently, to fishes, which see through the medium of water, which is thicker than air, whatever they see out of the water must appear to them more distant than they really are. On the contrary, if the eye is placed in a thin, or rare medium, like a clear atmosphere, objects that are in a thicker or denser medium, like water, will seem nearer than they are, and in some cases their size will be magnified. You are both so attentive, I will amuse you with another experiment, which will make this clearer to you than I can otherwise do.

Emily.

How kind you are, to divert us so agreeably.

Mrs. Dimsdale.

Bring me a bason. I will put a crown piece into it. Walk back a few paces: can you see the crown?

Lucy.

No: it lies in the bottom of the bason; and the side of the bason hinders me from seeing it.

Mrs. Dimsdale.

Fill the bason with water, and retire to the same distance.

Lucy.

How strange! I can see it plainly now; it seems raised by the water.

Mrs. Dimsdale.

The effect is caused by the refraction of the rays of light by the water, which brings the crown piece nearer to your eye than it really is: for if you look into the bason, you will perceive it still lies at the bottom, as it did before.

Lucy.

Lucy.

It is really so: I can no longer trust my own eyes.

Mrs. Dimsdale.

There is no sense so liable to deceive you as the sight. Observation, and the habit of examining things with exactness, are the best means of correcting its errors, and will enable you to trust to the representations of your eyes, without any danger of important mistakes. I am sorry you went to bed so early last night; had you sat up half an hour later, you might have seen a phenomenon not very usual. There was a lunar rainbow about nine o'clock in the evening. The moon shone bright, and the bow displayed the same colours as that we have just admired, only they were fainter.

Emily.

I suppose that was caused by the refraction of the moon's light upon the water in an opposite cloud.

Mrs. Dimsdale.

You judge rightly. There are also some-

times arches seen in the sky, of an evening, of great brightness, the colour of which is white, or yellowish, that are not caused either by the sun or the moon.

Emily.

What then can produce them?

Mrs. Dimsdale.

They are supposed to be of the same kind as those streaming lights of white, red, and yellow, that we observed some time ago, darting from the north, in a variety of forms and directions.

Lucy.

You mean the Aurora Borealis; but those streamers scarcely remained a moment the same, changing their colour and shape continually.

Mrs. Dimsdale.

Those who have seen the luminous arches, describe them as lasting ten minutes, or a quarter of an hour: and sometimes throwing out vivid flashes of coloured light; at other times growing fainter or stronger; and, at last, disappearing in patches, till the whole vanished

vanished entirely. The Aurora Borealis makes a beautiful appearance, occasionally, in our climate: but it is never seen here in so much perfection as in the countries near the poles, where the strong reflection of this meteor may be esteemed as one of the favours of heaven, to console the inhabitants of these dreary regions for their long deprivation of the light of the sun, which does not rise to them for months together in the winter.

Emily.

I am surprised they do not all leave such a dismal place, and settle where the sun rises every morning.

Lucy.

As they are used to live so long without sunshine, I suppose they do not feel the want of it.—Hark! it thunders: what a black cloud there is yonder; I believe there will be a storm.

Emily.

How majestically it rolls; and it lightens

excessively. It hails: the birds seem frightened, and hasten to the trees for safety.

Mrs. Dimsdale.

The weather has been very sultry lately. It will clear the air, and do a great deal of good.

Lucy.

What good can it do? I am always afraid of it, because I have heard that houses have been set on fire, and men killed, by lightning.

Mrs. Dimsdale.

Such accidents happen sometimes, but they are very rare: when the number of people that remain unhurt are considered, perhaps there is not more than one in twenty thousand persons who loses his life by lightning. Above all other reasons for restraining your apprehensions, you should remember, that He who forms the lightning directs its course; that our lives are at all times in his hand; and that nothing can hurt us without his permission.

Lucy.

I will endeavour to keep that in mind whenever

ever there is a thunder-storm; but you have not explained the benefits of thunder and lightning.

Mrs. Dimsdale.

There are probably some advantages derived from lightning that are not generally observed; but it is obvious that thunder-storms render the air pure and wholesome; they destroy insects, which would otherwise increase to a very inconvenient number; and they give to the rain a fertilizing quality, which makes vegetation flourish. In tropical climates, where the heats are excessive, and the air loaded with noxious vapours, it would be scarcely habitable, were not the atmosphere frequently cleared by thunder-storms.

Lucy.

If it did not make my eyes ache, I could look at the lightning with pleasure: it is the loud rumbling of the thunder that frightens me.

Mrs. Dimsdale.

The sound is indeed terrific; but before that reaches

reaches your ear, the danger is past. Thunder is merely the report of an explosion in the sky, when the clouds are loaded with electric matter, which discharges itself in flashes of lightning.

Emily.

I do not know what electric matter is.

Mrs. Dimsdale.

Electricity is a certain power, or quality, that is found in many substances, of attracting light bodies, after having been warmed by rubbing; and, in some cases, of throwing out sparks of fire, as you once had an opportunity of observing, when your cousin Charles caught the black cat, and rubbed her back the contrary way to the hair, in a dark closet. This effect was caused by the electricity of the hair.

Emily.

I remember it very well.

Mrs. Dimsdale.

Electricity, under particular circumstances, may be communicated from one body to another. This electric matter is supposed to rise from the earth into the higher regions of the

the atmosphere, and there to attract the watery particles together, till they are formed into clouds: one cloud filled with electric matter attracts another, till a vast mass is collected, which, when overloaded with electric matter, discharges itself in repeated flashes of lightning, frequently followed by loud claps of thunder, and often attended by violent rain and hail. This is called a thunder-storm; but would more properly be termed a lightning storm, as the thunder is only a consequence of the lightning.

Lucy.

If thunder is nothing but a sound, why did the ancients represent Jupiter holding a thunderbolt, like a flaming dart, in his hand.

Mrs. Dimsdale.

They were ignorant of the true cause of thunder, and believing that accidents which happened from lightning, were caused by the force of a solid body, they represented it under the form of a flaming dart, and used it as an emblem of sovereign power; and consequently a proper attribute for Jupiter, whom they

they worshipped as the king of heaven. In the latter ages of Rome, when they raised their emperors to the rank of divinities, they frequently placed the thunder-bolt upon the same medal with their heads.—The storm is over, and the evening is growing very fine: all nature looks revived. Let us prepare ourselves for a walk, that we may enjoy the pleasant change occasioned by the thunder-storm.

DIALOGUE IX.

LIGHT AND COLOURS.

Lucy.

I AM glad you are come, mamma. We have been in the garden this half hour, diverting ourselves with blowing bubbles of soap and water into the air, and admiring their fine colours.

Mrs. Dimsdale.

The great philosopher, Sir Isaac Newton, made

made use of such bubbles in his experiments on the nature of light and colours, which was but imperfectly understood before his time.

Emily.

Did he succeed in finding out what makes the grass green, the sky blue, and birds, and flowers, and butterflies of different colours?

Mrs. Dimsdale.

After much reflection, and many experiments, he discovered that the rays of light are composed of still smaller rays of different colours, which, when separated from each other by a prism, or piece of glass cut in a triangular form, each remains unchangeably of its original colour.

Emily.

Of what colours are these small rays?

Mrs. Dimsdale.

I will write them down for you, that you may learn them by heart. They are violet, indigo, blue, green, yellow, orange, and red. From these seven primary colours proceed the vast variety of hues that visible objects of all

kinds

kinds present to us, by the intermixture of one with another: thus, yellow and blue make green; red and yellow make orange; and so on, according to the order and proportions in which they are combined.

Lucy.

Pray what makes white?

Mrs. Dimsdale.

It is a mixture of all the seven original colours together. Bodies that appear white, reflect nearly all the rays of light that fall on them equally. Coloured bodies reflect chiefly those of that colour which distinguishes them, and absorb or swallow up the rest; for example, the scarlet poppy you see yonder, reflects only a mixture of red and orange-coloured rays; but the lily that stands by it, reflects the rays of every colour: on the contrary, substances that appear black, absorb instead of reflecting the rays that fall on them; that is, the rays of light are lost within them, and are not returned to the eye, as in other cases.

Lucy.

Lucy.

If the rays of light had been all of one colour, I suppose every thing would have been alike.

Mrs. Dimsdale.

It could not have been otherwise. Let us admire the goodness of Providence, who has so bountifully provided for our enjoyment by this single arrangement only of the composition of light, which produces such an innumerable variety of shades and colours, adapted to render the exercise of sight not only useful, but inexpressibly agreeable.

Emily.

That is a thought that never struck me before. We enjoy many pleasures every day, without being sensible of them.

Lucy.

I understand that the difference of colour between the leaves of the rose tree and the rose itself, arises from their reflecting, or sending back, rays of different colours, and absorbing all the rest; but what makes them reflect one

peculiar colour above others? or why does a ruby reflect the red rays, and a topaz yellow rays?

Mrs. Dimsdale.

It is a very natural question, that has puzzled wiser heads than ours; nor has it yet been clearly explained. We know the fact, but cannot satisfactorily account for it. The reasons that have been given for this property of bodies are too difficult for your comprehension at present. It is a curious circumstance, that it is sometimes possible to deprive substances of this quality, and to render things white, or colourless, which before were coloured. Gather that beautiful rose. It is now of a full crimson. When we go into the house, we will hold it over some burning sulphur, and it will lose its colour. The art of bleaching linen, cotton, and other manufactures, depends upon the same principle. The materials that are used deprive them of that quality which gave them colour. Things that receive their colour from dyes, lose part of it, or fade, by being exposed

posed to the heat of the sun's rays. Some philosophers have thought that animals, vegetables, and minerals, are all formed of an earthy substance, which is white; and that their different colours proceed from the addition of very minute particles of coloured matter, which, like the infusion of a dye to linen or silk, give a tint to the whole. This idea has arisen from a variety of experiments, in which the green colour has been extracted from grass and the leaves of plants; and the red, purple, and blue especially, from flowers. The whiteness of many parts of plants strengthens this opinion. Some flowers, you know, are naturally white; and the wood, pith, sap, cotton, seeds, and roots, are generally so.

Lucy.

The inside of a radish is white; it is only covered with a kind of coloured skin.

Emily.

And so are birds' eggs, and the shell of a lobster; the colour is only on the outside.

Mrs. Dimsdale.

The colours of many kinds of fruits are superficial; and Mr. Dalaval, who has paid great attention to this subject, found that feathers owed their colour entirely to a very thin layer of some transparent matter on a white ground. He examined several other animal substances, and some minerals, all of which, he had good reason to believe, owed their colour to the same cause.

Emily.

But there are many substances that are coloured throughout.

Mrs. Dimsdale.

Mr. Delaval supposes that the same principle may be admitted in those cases. The yellow colour of gold, which is coloured in all its parts, he attributes to a yellow transparent matter, that forms part of the peculiar substance of that metal, and is mixed equally with the white particles of the gold. He thinks that the light reflected by the white particles of gold, is transmitted through the yellow transparent matter; and that it is probable

bable that every white particle, though inconceivably small, is covered with the transparent yellow matter; as foils are made by covering white metals with transparent colours: in other words, it is his opinion, that all colours are produced by the transmission of light from a white ground, through a transparent coloured medium.

Lucy.

Pray explain the meaning of transmission.

Mrs. Dimsdale.

Its usual signification is, a sending from one to another; on this occasion it is used to express the passage of the rays of light through transparent bodies. Look through the green-house window: you see the plants within plainly, because the glass transmits the rays of light, or suffers them to pass through it. Close the shutter; you can no longer see into the green-house, because the shutter, being an opake body, intercepts the rays of light.

Emily.

I thought you told us that glass refracted the rays of light.

Mrs. Dimsdale.

Glass, and all other transparent bodies, transmit and refract the rays of light at the same time. The rays pass through them, though not in their direct course. Children, observe the distinctions I am going to make. A ray of light is said to be direct if all the points that compose it lie straight between the radiant and the eye: if it be bent out of its course, it is refracted; if driven back, it is reflected; and if it pass through any medium, it is transmitted. A little attention will make these terms familiar to you, and enable you to understand more clearly what I have been telling you.

Emily.

I suppose the sun and moon are radiants.

Mrs. Dimsdale.

Any object from which rays proceed to the eye is a radiant. There is an important difference, however, between the light of the sun and that of the moon. The sun is a luminous body; that is, his light proceeds from himself. The moon is only an illuminated body; because

because the light she reflects is received from the sun. Give me some example, that shall show you comprehend me.

Emily.

Luminous bodies are such as shine in the dark; or rather, where there would be no light without them. A candle, I suppose, is a luminous body: and your diamond ring, when it sparkles, from the light of the candle shining upon it, is an illuminated body.

Mrs. Dimsdale.

Very well explained.

Lucy.

How do you account for the brilliancy of diamonds, and other precious stones?

Mrs. Dimsdale.

From their extraordinary degrees of refraction. The more powerful the surface of a transparent body refracts, the greater quantity of light it reflects, which is the cause of their sparkling with such brilliancy; and their display of vivid colours arises from their separating the different coloured rays, as in a prism, classing all those of one colour together.

Lucy.

Lucy.

I cannot understand how the rays of light that are reflected from any object can reach your eyes and mine, and those of twenty other people, if they happen to be in sight of it, at the same time.

Mrs. Dimsdale.

Every point of a visible object reflects innumerable rays every way, which, by emanating in all directions, reach the eyes of any number of beholders, without interfering with each other. The eye is formed to receive the rays, which, passing through the pupil, fall on the back part, called the retina, and there represent an image, or picture, of the objects of sight, as we see things in a looking-glass reflected in their proper shape and colour. Nothing can be more admirably adapted to their design than the different parts of the eye, as well as the peculiarities of the eyes of different animals.

Emily.

We will be very attentive, if you will tell us

us how the eye is formed, and what are the uses of the different parts.

Mrs. Dimsdale.

It is too late to begin such a subject. We must go into tea; but whilst you work to-morrow morning, if I see that you are industrious, perhaps I may indulge your laudable curiosity.

DIALOGUE X.

THE EYE.

The human Eye compared with those of Animals.—The Gnat.

Emily.

We have both brought our work-bags, and are come to claim your promise of telling us some curious things about the eye.

Mrs. Dimsdale.

I am willing to perform my engagement; but

but you are too young to comprehend more than a general description of some of the most obvious parts. When your understandings are more advanced, I will request a friend of mine, who is an anatomist, to dissect an eye, and give you a lecture upon it.

Lucy.

That will afford us a better notion of it.

Mrs. Dimsdale.

Before I describe the eye, I shall point out the uses of some of its appendages.—The eyebrow is not merely an ornament, but is placed above the eye to moderate the force of the rays of light; the eyelids, with the fringed hairs that surround them, perform the same office, and also prevent the entrance of dust, flies, or other small substances, which might hurt this delicate organ. Besides covering the eye during sleep, and when exposed to danger, they serve, by their frequent motions, to wipe and keep it clean, they assist also in diffusing the tears and oily moisture from the glands, which

are

are continually discharged in order to promote the easy motion of the eye. The edge of the under eye-lid stops the tears, and conducts them to a small hole, formed in the fore corner of the same eye-lid, through which they fall into a little bag, called the tear-bag; at the bottom of this receptacle is a fine tube, or pipe, that gives them a passage to the nose.

Lucy.

This is plainly the reason why so much water runs from the nose when we cry.

Emily.

I had no notion that we ever shed tears without crying.

Mrs. Dimsdale.

We do not shed them unless they overflow the eyelid: the usual discharge, as I have already remarked, is carried off. Without this continual moisture, the surface of the eye would grow dry; nor would it slip so easily under the eyelid, when turned from one point of view to another, as at present. The eye is moved by six muscles, which are

fleshy

fleshy fibres, that have the power of stretching out and contracting. The muscles of the eye may be compared to elastic strings, which pull it whatever way is wanted: thus, by contracting the proper muscle, we turn our eyes either upwards, downwards, or sideways. These muscles, the optic nerve, and the whole globe of the eye, lie in a soft bed of fat, which greatly assists the eye and the muscles, in the great variety of motions of which they are capable.

Emily.

What a curious apparatus belongs to the eye! Since the outward parts are so nicely contrived, surely the eye itself will still more deserve our admiration.

Mrs. Dimsdale.

Let us next remark the situation of the eye, which is the most convenient that can be imagined for the purposes of sight. Its form resembles that of a globe, when taken out of the cavity that contains it; it consists of three distinct fluids, or humours, as they are generally called, enclosed within several coats,

coats, or coverings. The outward coat covers the whole eye, except that part which we call the sight: immediately under this lies another coat, which covers the whole; but with this precaution, that it is transparent, like horn, on the fore part, and from that circumstance has received the name of cornea. This membrane contains the aqueous humour, which is a clear, transparent fluid. The choroides is the next coat, and is likewise transparent in front: beneath the transparent part of it lies the chrystalline humour, which resembles a clear ball of jelly. The vitreous, or glassy humour, fills all the hind part of the cavity of the globe, and gives it its roundness; behind it is spread the retina, which is like fine net-work, and covers the bottom of the eye, opposite to the sight. On the retina are painted the images of visible objects: but how these images are conveyed to the mind we know not. The large pair of nerves, which pass from the eye to the brain, are supposed to be the means of communication; but it cannot be explained

in what manner this operation is effected, as we are wholly ignorant how the mind acts upon the body, or the body upon the mind. That striped, variegated circle called the iris, which varies in colour in different persons, (whence we say that such a one has blue, grey, or black eyes,) is formed from a part of the choroides that is double. Near the centre of this circle is a little dark spot, named the pupil, through which the rays of light pass to the retina. The different humours serve to refract and reflect the rays in such a manner, as those only which are required for impressing images in the retina should pass through the pupil, which is nothing but a small opening left free for that purpose; but as there are some occasions when the admission of more or less rays are necessary, the iris has the power of enlarging or diminishing the size of the pupil, by means of fibres that act contrary ways, an alteration that takes place on our change of situation: when we go into a glaring light, the pupil is contracted, to prevent the eye from being overpowered

overpowered; but if we remove into an obscure place, or into the dark, the pupil expands, that it may collect as many rays as possible. Besides the parts I have mentioned, the eye is amply furnished with glands, veins, and arteries, by means of which the blood is circulated through it.

Lucy.

The pupil in the eye of the cat differs in shape very much from ours: it is like a black line drawn lengthwise.

Mrs. Dimsdale.

The cat has the power of opening it very wide, and shutting it very close, which enables her to see well both in the light and in the dark; a useful quality to an animal whose prey lurks in holes and corners. In the horse, the sheep, and the ox, it is an oblong, placed across the eye, that they may be the better able to see on each side, and avoid any thing hurtful to them; as well as to discern their food, which is spread upon the ground. It is probable that all creatures that feed in the night, as they require the capacity

of collecting a great quantity of the rays of light, are furnished with large pupils, as is the case with these animals.

Lucy.

I should be vastly entertained with hearing the same parts of different animals compared together.

Emily.

So should I; but I would rather hear some more particulars of the different kinds of eyes, before we begin upon any other subject.

Mrs. Dimsdale.

In man, the eye is placed chiefly to look forward: but so as nearly to take in the hemisphere, or half the circumference of the horizon: in birds, and some other creatures, they are so fixed as to enable them to see the greatest part of the circumference of the horizon at once, that they may be the better able to seek their food and escape danger. The eyes of hares and rabbits are placed so much towards the sides of the head, that they can see nearly all round them; but the eyes of the dogs which pursue hares and rabbits,

are

are set forward in the head, having but little occasion to look backwards, as their game always runs before them.

Lucy.

I suppose such creatures as the crocodile, the frog, the snail, and many insects that cannot move their heads, can see only straight forwards.

Mrs. Dimsdale.

In those animals that are deprived of this advantage, some other contrivance is generally adopted, better suited to their manner of life. The head of the snail is immoveable, but its eyes are fixed on the tips of its flexible horns, which can be turned, at pleasure, from one side to the other. Spiders have no neck, and consequently cannot turn their head: to make them amends, they are furnished with four, six, or eight eyes, resembling a locket of diamonds, which renders them capable of catching their prey, which is the common fly, a nimble and timid insect, that would mostly escape, if they were obliged to turn their heads to look for it. The eyes

of fishes differ extremely in their size, figure, and situation; and are, doubtless, regulated by a wise accommodation to their different modes of living; but as the element in which they live conceals their habits from our notice, I shall pass over their particularities, and remark, that the eyes of the mole, which was formerly thought to have none, are wonderfully adapted to its situation. They are exceedingly small, and being fixed far back in the head, and closely guarded with strong hair, are preserved from the injury they would be liable to feel, from the dirt falling into them, in the creature's progress underground; but when it comes to the surface of the earth, it is thought to have the power of pushing them forward, and bringing them into use. Frogs, and many birds, as also the crocodile, have a strong, transparent membrane, that they can draw over their eyes at pleasure, when any thing is likely to hurt them. The eyes of flies being immoveable, as well as their heads, they would be greatly exposed to their enemies, were it not for the multitude of eyes

with

with which they are supplied. Their eyes are like a fine net-work of diamonds; each eye being an assemblage of many thousands of small, but perfect eyes. Those who have examined them with very powerful microscopes, pretend to have seen eight thousand in the two eyes of a common fly, and a much greater number in some other insects; but, without relying on the exactness of their reckoning, we may be assured that they are extremely numerous. Besides these eyes, composed of so many brilliants, they have likewise single eyes, differing in number and situation in flies of different species: these single eyes are very small, compared with the whole cluster of a reticulated eye; but a great deal larger than any single eye in the compound ones.

Lucy.

Have butterflies reticulated eyes?

Mrs. Dimsdale.

Yes; most of the different classes of flies have two of these eyes, composed of an innumerable group: the colour of these clustered

tered eyes is various in different species; some are brown, others yellow, others green, and others red, differing in all the shades of those colours. Some are likewise much more transparent and brilliant than others: the pearl eye of the dragon-fly resembles shagreen, when seen through a magnifying glass.

Lucy.

Here is a gnat upon my arm; I wish I could examine his reticulated eyes.

Mrs. Dimsdale.

I have not a microscope at hand; but you may perceive that his head is very small: his eyes are proportionably large, and nearly meet each other, covering the greatest part of his head, as with a coronet of jewels. His thirst for blood makes him a troublesome companion, though his curious structure draws our admiration.

Lucy.

How he stings! I can see his proboscis fixed to my arm.

Mrs. Dimsdale.

With that instrument he pierces the flesh, and

and sucks the blood, which seems to be his natural food. To an inconsiderate person, a gnat may appear a minute and insignificant member of the great family of animated nature, yet the Universal Parent has condescended to provide, in an admirable manner, for every enjoyment of which he is capable: he is furnished with fine light gauze wings, to transport him wherever he pleases; his head, encircled with eyes, enables him to see all the objects about him, in every direction; his talons are so sharp, or gummy, that he can walk on the upright panes of a glass window; his feet are supplied with brushes, for cleaning his wings and his head; a plume of feathers adorns his forehead; and he sounds a trumpet to give notice of his approach.

Emily.

Are all gnats alike? I think I have observed several kinds.

Mrs. Dimsdale.

There are many species of them. A great naturalist, Dr. Derham, observed forty kinds in the county of Essex.

Lucy.

Lucy.

There are always great numbers of them buzzing about the water side, on a summer's evening.

Mrs. Dimsdale.

This creature undergoes several metamorphoses. Its first state of existence is in the water; in standing ditches and ponds especially; which accounts for the swarms that are seen in warm weather, hovering in the air, in many places. From the egg laid by gnats, on the surface of the water, proceed a number of minute worms, which, sinking to the bottom of the water, as soon as they are hatched, form for themselves coverings of fine sand, or earth, cemented together with a sort of glue, but open at both ends, that they may go in and out as they please. Before the gnat-worms have attained their full growth, they are obliged to come frequently to the top of the water, in order to take breath: this they do by keeping the end of a small pipe, which issues out of their bodies, above water. The worm belonging to the largest species of gnats,

gnats, changes its skin three times before it leaves the worm state and becomes a nymph. It is now shorter and rounder than before, and the body bent like a ring: but even now it has the power of stretching out its tail, and swimming about swiftly. When these insects have quitted their first habitations, and the figure of worms, they rise to the top of the water, enclosed in a kind of case, with a large head and mouth, two black eyes, two horns, several tufts of hair on different parts of the body, and a tail with a brush of hair at the end of it, which being smeared over with an oily fluid, serves to keep them above water, and enables them to steer where they please, without being wetted or injured by the water.

Lucy.

In future I shall observe attentively all the insects I see; for I suppose there are other kinds, equally wonderful in their form and habits.

Mrs. Dimsdale.

You will do well to acquire the habit of attentive

attentive observation. There is almost as much difference between those people who are nice observers, and those who carelessly pass over every thing they see, as between the blind and those who have their sight. To the minute examiner, an insect, a leaf, or a feather, affords subject for admiration and acknowledgment of the wisdom and goodness of that Great Being, by whom they were formed with parts and inclinations so exquisitely adapted to the ends for which they were designed; whilst, to persons of the other description, they are disregarded as trifling or contemptible. Children, you have been confined already too long; go abroad and amuse yourselves.

DIALOGUE

DIALOGUE XI.

Singing of Birds.—Natural History of the Cuckoo.

Lucy.

EMILY, open the window, that we may hear our favourite blackbird the better, as he sits there on the cherry-tree, warbling to his mate.

Emily.

Pretty fellow! if he knew how secure he is here, he would never expose himself to the sportsman's gun, by wandering from the garden.

Lucy.

I suppose singing is the language of birds. I should like to understand what he is saying: perhaps he is giving directions to the young ones before they venture abroad.

Emily.

It is likely that birds have some method of

conveying their meaning to each other; but I do not think that singing is their language, because they do not sing at all the greatest part of the year. Hens scarcely ever sing; and many kinds of birds have no song. Were that the case, large birds would be all dumb, and unable to make their wants known to each other; for I have heard that no bird larger than a blackbird is known to sing.

Lucy.

That is very strange: I should have thought that the stronger the bird, the more capable it would be of exerting its voice.

Emily.

Since large birds cannot so easily conceal themselves as small ones, a fine voice would have been a dangerous gift; for the louder their song, the more they would have been exposed to their enemies. Nor do I think that their capacity of singing depends so much on the strength of their bodies, as on something particular in the throat. But here comes mamma; she will have the kindness to tell

tell us what is supposed to enable a bird to sing well.

Mrs. Dimsdale.

Mr. Hunter, the anatomist, dissected several birds, both male and female, in order to discover what were the distinctions of those which excelled in vocal powers; and he found the muscles of a part of the throat, called the larynx, (which is the instrument of voice in man, as well as birds,) strongest in those birds which had a superior capacity of singing, and stronger in the male than in the female; but it is remarkable, that in those that could not sing, there was no such difference observable between the cock and the hen. The Honourable Daines Barrington, who has paid great attention to this subject, says, that though the power of singing depends upon the original formation, yet it is greatly promoted by plenty of food.

Emily.

I have often wondered why birds in cages should sing all the year round, except while they are moulting, as those at large sing only

a few months: but this accounts for it, as they are fed as well in winter as in summer.

Mrs. Dimsdale.

Birds in a wild state seldom sing longer than ten weeks in a season.

Lucy.

But that is always in the spring, when small birds can find plenty of such food as they like; for they live chiefly upon the buds of plants, fruits, seeds, and insects.

Mrs. Dimsdale.

The first sound a bird utters is a cry for food. This chirp is known, by nice observers, to differ so much in every species, that a person skilled in the matter can distinguish what kind of birds are chirping, though the nest be out of sight. When young birds are about a month old they begin to call; which is only a repetition of a single note, and is probably a significant sound, understood by their companions, as it is common to both sexes, and is continued through their whole lives. When the cocks grow older, they make frequent and repeated attempts

attempts to learn to sing, and are often ten or eleven months before they are perfect in their lesson, which, when once attained, continues, without any alteration, from season to season. The irregular notes, expressed by birds in learning their song, are called by the birdcatchers, *recording*. We may observe, that practice and perseverance are so necessary to bring any thing to perfection, that even a bird, without them, cannot learn to chaunt that peculiar song, which, from being common to the species, we are apt to call natural.

Emily.

Is it not natural? Surely every linnet would have a linnet's note, were he never to hear other linnets sing.

Mrs. Dimsdale.

I was once of your opinion, but since I have read Mr. Barrington's experiments, it appears clearly that their singing is the effect of imitation.

Lucy.

Pray tell us what his experiments were.

Mrs. Dimsdale.

He deprived several nestlings of the opportunity of hearing their parent's song, by taking them from the nest when very young, and placing them where they could hear only the notes of birds of a different species. Amongst others, he brought up a linnet under the tuition of a tit-lark, and when he was perfectly grounded in the tit-lark's song, he hung his cage near those of two linnets; yet he never learnt their notes, which might have been supposed natural to him, but continued to sing like a tit-lark. He gave to another linnet, an African bird, called a vengolina, for a tutor, and he succeeded equally well in imitating his master. It sometimes happened, that when he placed a young bird near several others of different kinds, he performed a song out of their notes, partly like each of them, but not exactly like any of them; and, in some instances, they showed a sort of choice, and adhered to the song of a favourite teacher, in preference to every other model.

Emily.

Emily.

I should like to try how a bird would sing, that had never heard the notes of any other bird.

Mrs. Dimsdale.

It is most probable it would not sing at all. Mr. Barrington mentions a goldfinch, which had no opportunity of learning to sing, that, instead of singing, articulated the words, "pretty boy," which had been often repeated to him.

Emily.

Since birds sing from imitation only, I suppose a man brought up in a desart would not speak.

Lucy.

Peter the wild boy, who was caught some years ago in a forest in Germany, could not speak when he was first taken, nor did he ever learn to converse.

Mrs. Dimsdale.

Men certainly speak from imitation; birds do the same with respect to singing; each of them are furnished by nature with the proper

per organs, but without repeated efforts to imitate the sounds for which these organs are adapted, neither are capable of using them. In infancy, children imitate their parents and nurses, at first by simple sounds; in time they reach words; and, by degrees, put words together; till, as their ideas increase with the improvement of their powers of articulation, they attain the complete use of the language of the country in which they live; and there are but very few instances of persons, when grown up, acquiring the pronunciation of a foreign language with the accent of a native. Birds, in a wild state, are attached, by tender ties, to their parents, till they are old enough to provide for themselves; and keeping constantly close to the old ones, they listen to the song of the cock parent with much greater attention than to that of any other bird; which sufficiently accounts for all the individuals of one species singing nearly alike.

Emily.

If a goldfinch could be taught to speak, a faculty

a faculty that seems quite unnatural to him, perhaps some birds might be taught to sing that never attempted it in a wild state.

Mrs. Dimsdale.

Mr. Barrington actually succeeded in teaching a sparrow to sing, by educating him under a linnet; but a goldfinch happening to hang within his hearing, he formed a song that partook of both.

Lucy.

If a sparrow, that does nothing but twitter, could imitate a linnet and a goldfinch, I do not see why all birds might not be taught to sing.

Mrs. Dimsdale.

Further experiments alone can decide what birds are capable of learning to sing, and what are not. Where the proper organs are not wanting, there seems to be a disposition not only to imitate, but to excel those they hear. Superiority in song gives an amazing ascendency to one bird over another, as is well known to bird-catchers, by the fascinating power

power of their call-birds, which, by art, are made to moult sooner than their natural time, and consequently they are in full song when the wild birds are not so.

Emily.

Of all the singing birds, whose note I know, the nightingale is my greatest favourite.

Mrs. Dimsdale.

You show your taste: the nightingale has no superior, and but few rivals; the value of his song is likewise enhanced by being heard at night, when most other birds are at rest. In a still, calm evening, it is said, that this little warbler may be heard at half a mile's distance, which, considering his size, is very surprising.

Lucy.

Sister, did not you once see an American bird, that imitated the notes of all other birds?

Emily.

You mean the American mocking bird. The one I was shown, imitated, in the space of

of a minute, the wood-lark, chaffinch, blackbird, thrush, and sparrow; he likewise barked like a dog, and sometimes sang almost as melodiously as a nightingale. He is not much bigger than a lark, has a long tail, and is of a deep blue colour. With this extraordinary capacity of imitating others, I did not hear whether, in his native woods, he had a melodious song of his own.

Mrs. Dimsdale.

That circumstance is not well ascertained.

Lucy.

Is the cry of the cuckoo called its song?

Mrs. Dimsdale.

I think it cannot properly be termed so, though the cry is confined to the male bird; and he seems to repeat cuckoo, cuckoo, with as much pleasure, and probably with the same design, as birds sing.

Emily.

There is a common notion that the cuckoo builds no nest, but lays her eggs in the nest of some

some other bird, and leaves it to be hatched by a stranger.

Mrs. Dimsdale.

The fact has been decisively proved by Mr. Jenner, who has examined a great number of nests, for the purpose of ascertaining it; and in those belonging to the water-wagtail, the tit-lark, the yellow-hammer, the green-linnet, the whinchat, and especially the hedge-sparrow, he frequently found a cuckoo's egg, or a young cuckoo, but not more than one, except in two instances; and it is rather extraordinary that it should ever happen, as one cuckoo only can be reared in the same nest, because the strongest will not suffer his companion to remain there.

Lucy.

I do not see how he can hinder it.

Mrs. Dimsdale.

Mr. Jenner relates, that two cuckoos and a hedge-sparrow were hatched in the same nest, on the same day: one hedge-sparrow's egg remained unhatched. In a few hours a contest

contest began between the cuckoos for the possession of the nest, which continued undetermined till the next afternoon, when the largest of the two turned out the other, together with the young hedge-sparrow, and the unhatched egg. The method he took to accomplish this was very curious: the little animal, with the assistance of its rump and wings, contrived to get its rival upon its back, and making a hollow for it, by raising its elbows, clambered backward with it up the side of the nest till it reached the top, where, resting for a moment, it threw off its load with a jerk, and disengaged it clearly from the nest; then, feeling about with the extremities of its wings, that it might be certain it had got fairly rid of its antagonist, it dropped quietly into the nest again. The form of the young cuckoo shows that nature has designed it should free itself in this manner from all rivals in the same nest, the back being remarkably broad towards the bottom, with a considerable hollow in the middle. When the bird is about twelve days old, and has no

longer occasion to employ its forces in turning its foster-brother out of the nest, this cavity is filled up, and its back assumes the shape of nestling birds in general.

Emily.

There is something odious in the disposition of a cuckoo, that will not share benefits with another.

Mrs. Dimsdale.

This extraordinary instinct is given to the young cuckoo for its own preservation, and the accommodation of its adopted parent, who, being of a much smaller species, would be unable to provide for its own family and the wants of its inmate, who would probably require as much food as the whole of its own progeny. The disproportion in size between the cuckoo and the hedge-sparrow is so great, that before the cuckoo is fully able to feed itself, the hedge-sparrow is obliged to perch upon its back, or half expanded wing, to be able to reach to put the food into its mouth.

Lucy.

I am surprised that the instinct of the parent cuckoo

cuckoo should suffer her to lay two eggs in one nest, since only one of them could be reared in it.

Emily.

They were most likely laid by two different cuckoos, the last of which was not aware that another had been there before her. How strange it is, that the cuckoo should differ so widely from birds in general, who are so tenderly fond of their young. She may be compared to those ladies who give their children to strangers to nurse, when they are as capable of doing it themselves.

Mrs. Dimsdale.

An apology may be made for the cuckoo, which cannotbeurged in favour of women who voluntarily abandon their children: they are birds of passage, and remain in this country, where they breed, too short a time to build a nest and rear their young. Nature, who is never deficient in accomplishing her purposes, has appointed this extraordinary means of preserving this species of birds, without the attention of the mother, which,

in most other cases, is so necessary for the welfare of the infant progeny.

Lucy.

To what countries do they go, when they leave us?

Mrs. Dimsdale.

They are supposed to migrate to Africa, as they are found twice a year in their travels backwards and forwards, in the island of Malta. In summer they visit some parts of Europe still further to the North; but they make their visit later, as the climate grows colder. There are a great many species of them that inhabit different parts of the globe; but I do not know whether they have the same habit of depositing their eggs in the nest of another bird, as the common cuckoo with which we are acquainted. The food of this bird is composed both of vegetables and insects, particularly the grasshopper and smooth caterpillar. My dear children, our conversation has made us forget how the time passes. You have scarcely a quarter of an hour to prepare yourselves for your visit.

DIALOGUE

DIALOGUE XII.

PROGRESS OF CIVILIZATION.

Lucy.

I HOPE you remember, mamma, that you have promised to answer the questions to-day which we wanted to ask last night.

Mrs. Dimsdale.

I am willing to satisfy your curiosity, as far as I am able: but perhaps your enquiries will exceed the bounds of my knowledge.

Emily.

I suppose sun-dials, or hour-glasses, such as I have seen in cottage windows, were used to tell the time of day, before they contrived to make watches or clocks.

Mrs. Dimsdale.

It is not likely that any machines to measure time were invented, till some advances had been made in astronomy. The rising

and setting of the sun occasioned too striking a change to be unobserved by the most stupid and ignorant, and naturally divided their time into night and day. Observation would soon inform the first inhabitants of the earth, that the days were not all of the same length; this circumstance, with the variations from heat to cold, would teach them to divide the year into the four seasons, spring, summer, autumn, and winter: but still without much exactness, till they became acquainted with the motions of the heavenly bodies. The changes of the moon were regular, and obvious to every one, and conveniently formed another division of the year into months. The appearance of a new moon was celebrated as a festival in many countries, and is still hailed with religious ceremonies by some savage nations.

Lucy.

They have got to days, months, and years; but how did they find out the hours?

Mrs. Dimsdale.

To accomplish that point, it was necessary

to

to divide the time from one sun-rising to another into equal parts, and it is most likely that different devices were adopted in different places. The Romans measured time by water; the same quantity pouring from one vessel to another, in like manner as the sand passes from the upper to the lower side of the hour-glass, whichever way it is turned, in an equal time. Some persons of ingenuity, who had observed with attention the regularity of the shadows reflected by fixed objects, took the hint from them of making a sun-dial; the first that is mentioned in history was erected by Papirius Cursor, at Rome. Clocks and watches, capable of marking even the moments with exactness, are machines of later invention, which required great skill in mechanics to bring to perfection. A striking clock was unknown till the end of the twelfth century; the only means, therefore, of knowing the hour during the night, was by employing men to parade the streets, and call out the time: a custom still used by our watchmen; though the object of hiring them now, is

is to guard our houses and property from the depredations of thieves.

Lucy.

How those Romans, who admired Papirius Cursor's sun-dial as a wonder of art, would be astonished to see the musical clocks that were shown in Cox's Museum.

Emily.

The clocks at Cox's Museum were far more beautifully decorated with pearls, and rubies, and golden ornaments; but I do not think they were more curious than that fine clock that stands in the hall, at the manor-house: it chimes the quarters; shows the day of the month, and the changes of the moon; and I know not what besides.

Mrs. Dimsdale.

Mechanism has attained great perfection, not only in watches and toys, but likewise in various kinds of machines and mill-work; without which we should be at a sad loss to perform many laborious works, far beyond the strength of one, or a considerable number of men, in the same time.

Emily.

Emily.

I love to see the great wheel turn round, and hear the heavy stampers thump, thump, at the oil-mill, when we walk by the river's side, on a fine still evening.

Lucy.

Before they contrived to build mills, what did they use instead of them?

Mrs. Dimsdale.

The first contrivances, as in other things, were simple. Before corn was plenty, it was ground in small mills, turned by men: this servile, laborious employment, was imposed upon slaves, or captives taken in war. As tillage improved, corn was raised in larger quantities, and this method of converting it into flour was too tedious: mills, turned by horses, were found more convenient; but when men came to make bread a principal part of their diet, something still more expeditious was required; wind-mills, and, lastly, water-mills, succeeded, which ground immense quantities of corn in a short time. The principle of setting these powerful machines

chines in motion being once discovered, was soon applied to many other purposes, besides the grinding of corn, as you must know from your own observation.

Emily.

Oh, yes; we have seen several other mills: a paper-mill, a saw-mill, and a fulling-mill.

Mrs. Dimsdale.

There are also silk-mills, used for spinning and twisting silk; and mills for beating and forming iron into bars, anchors, and other large masses.

Lucy.

You have forgotten the mills for making gunpowder. The terror I felt, when those were blown up that shook our parlour windows so violently, has reminded me of them.

Emily.

You say that captives, amongst the ancients, were employed to turn the hand-mills. That custom accounts for the cruelty of the Philistines, in making poor Sampson work in the mill, after they had put out his eyes.

Mrs.

Mrs. Dimsdale.

The Philistines had received many provoking injuries from Sampson, and were glad to retaliate when they got him in their power, by putting a person of his consequence to so servile a task.

Emily.

Revenge is a hateful quality: but it agreed with the other parts of the character of the Philistines, who appear to have been treacherous and cruel.

Lucy.

When you showed us the prints belonging to the history of England, I remarked that the Ancient Britons were almost naked; and on their bodies were traced stars, and the figures of animals.

Mrs. Dimsdale.

A mantle of skin, thrown across the shoulders, was almost the only clothing worn by the native inhabitants of this island, when Cæsar invaded it, which doubtless arose from their ignorance of manufactures. Their bodies were frequently stained all over with a deep

deep blue colour, perhaps for warmth, and then painted with various figures, according to the rank of the person who was thus adorned. In the interior parts of the country agriculture was unknown; the people fed upon milk and flesh; and lived in houses, consisting only of one large circular apartment, with a fire in the middle, round which the whole family, men, women, and children, slept promiscuously on the floor, which was covered with straw or rushes. The manner of eating their meals was not much more delicate: they formed a circle on the ground, with a low table, or stool, placed before each person, on which was put their portion of meat; one large knife served the whole company, to divide the larger pieces of flesh: the smaller ones they tore to pieces with their hands and teeth. Their dishes were either of wood, a coarse sort of earthen-ware, or a kind of basket made of osiers, an art in which they were very expert. Their drinking vessels were either the horns of oxen, and other animals, or large shells found on the sea-shore.

sea-shore. Feasting was their principal amusement, in which temperance was but seldom observed, either in eating or drinking. Whilst the men were employed in war or hunting, the women performed all the drudgery of household affairs, and managed the whole concerns of the family; a task that their husbands thought beneath their attention. In short, they were little better than savages, till they learned the arts of civilization from their Roman conquerors, who polished their manners, and made ample compensation for the wild independence they enjoyed before their invasion of the island, by the general diffusion of knowledge and improvement.

Lucy.

I suppose, from this account, that it is no misfortune to a savage nation to be subdued by one that is civilized.

Mrs. Dimsdale.

History is our best guide in this subject; from it we learn that it was the wise policy of the Romans to civilize all the nations they

subdued, by introducing their arts, and admitting the vanquished to the privileges of Roman citizens, which gradually blended the conquered provinces into one vast empire. But it was far otherwise when the Spaniards conquered South America. The principal view of the adventurers who engaged in that enterprize, was the finding of gold mines, in which the country abounded. Eager to grow rich, they first plundered the harmless natives, and then subjected them to the most abject slavery; in which they continue to this day, untaught, uncivilized, and deprived of the common rights of mankind. So it is not always a benefit to an ignorant people to be vanquished by a nation wiser than themselves; unless that wisdom is used to promote their welfare, and improve their condition.

Emily.

After the Romans settled in Britain, I suppose the people soon learned to build such houses as ours, and live as we do now.

Mrs.

Mrs. Dimsdale.

Whilst the Romans remained amongst them, they learned many useful arts, as may still be seen by the ruins of many public works, such as roads, fortifications, and other buildings: but when the Romans were obliged to withdraw their protection, the Britons were long harassed by repeated incursions from their neighbours, and, in turn, became subject to the Danes, the Saxons, and finally to the Normans, who ruled them very oppressively, and reduced the mass of the people to the condition of slaves. The spirit of improvement was lost; for what motive could men have to exercise their ingenuity, who had nothing of their own to enjoy: all their possessions, (if so they could be called,) with their lives, were at the disposal of an imperious master, who lived in a continual state of warfare, either with his neighbours, his sovereign, or a foreign enemy. Domestic comfort was then but little known in any rank. The great, when not engaged in military enterprises, spent their

time in the chase, or shut up in their castles, in a kind of barbarous magnificence. They neglected the cultivation of their minds to so great a degree, that few, except the clergy, could read.

Lucy.

What an improvement since that time! Now almost every body learns to read. I do not think there is a poor child in our parish but is taught, either in the Sunday school, or one of the charity schools.

Mrs. Dimsdale.

Though they were very inferior to the present age in learning and domestic comfort, yet, including a few centuries after the Norman conquest, they had advanced greatly beyond the state of the Ancient Britons, in arts and manufactures of various kinds, as is shown by the dress of a beau in the days of Henry the Fourth: he wore long pointed shoes, fastened to his knees by gold or silver chains; a stocking of one colour on one leg, and one of a different colour on the other; short close breeches, that reached but half way

way down his thighs; a coat, one half white, the other half black or blue; a long beard; a silk hood, buttoned under his chin, embroidered with grotesque figures of men and animals, and sometimes ornamented with gold, silver, and precious stones.

Emily.

What a comical figure! Were I to meet a man dressed in this fantastical manner, I should think he had escaped from a madhouse.

Mrs. Dimsdale.

Custom reconciles many absurdities. Some of the fashions of modern times are not much less ridiculous; but, by being used to see them every day, we do not see their inconsistency with true taste and convenience.—But, to recal your attention to our subject. From the description of this motley garb, we may discover that our ancestors of this period had learned to fuse metals, to polish precious stones, to weave silk, to dye colours, and consequently to make a variety of tools, used in these different arts: nor can there be a doubt

that there was a proportional improvement in architecture and agriculture, as well as in the materials for clothing. The ladies of that day were the counterpart of the gentlemen, in their dress, and were masculine in their manners: they wore short swords, and rode from place to place on high-spirited horses, attending every tournament they could reach.

Emily.

I do not know what a tournament is.

Mrs. Dimsdale.

It was a military combat, between two knights, or warriors, of rank, in order to display their skill: at some future opportunity, perhaps, I may give you a more full account of this diversion; at present it will engage too much time.

Lucy.

Why did not the ladies ride in coaches? It would look very strange now, to see them on horseback, in full dress.

Mrs. Dimsdale.

For a very good reason; because there was no such thing till long after their time.

Coaches

Coaches were introduced about the year 1580, till when, Queen Elizabeth, on public occasions, rode on horseback behind her chamberlain. The Chinese, though a very civilized nation, do not yet use coaches: the people of rank there, and in many other parts of Asia, ride in a kind of chair, covered with a canopy, and carried on men's shoulders, called a palanquin. A few years ago, when Lord Macartney went over to that country on an embassy, he took with him an English post-chaise, which excited no less surprise in the multitude than terror in a mandarin, or nobleman, whom he persuaded to accompany him a few miles in it. The produce of our gardens was greatly increased about the reign of Henry the Eighth: there did not grow in England, before that time, either cabbage, carrot, or turnip; nor could Queen Catharine, his first wife, be furnished with a salad, till he engaged a gardener from the Netherlands. The delightful and useful art of gardening made a rapid progress: the artichoke, the apricot, the damask rose, were introduced

introduced about the same time; and, in the space of a few years, the currant tree and the cherry were added to the number of our fruit trees.

Lucy.

I thought such things had always grown here, naturally.

Mrs. Dimsdale.

That supposition arose from their being cultivated without much trouble, and thriving here, as in their native soil; but you must not judge from that circumstance: many other things, that flourish equally well, have been brought from foreign countries, animals as well as vegetables. That useful root the potatoe, was not known till 1623. Turkeys were brought from America: the first turkey brought to table in France, was at the wedding feast of Charles the Ninth, in 1570. Thus you see that a friendly communication between distant nations may be rendered very serviceable to both parties. The late Captain Cook, whose memory must ever be revered, was assiduous in carrying the seeds of such plants

plants as he thought would be beneficial to those countries he visited, and brought others home in return: he engaged in a laborious course of life, and exposed himself to many dangers for the good of mankind. To men like him the world is really indebted, and may, without false praise, bestow upon them the title of heroes.

Emily.

I wish you would tell us the whole history of his voyage.

Mrs. Dimsdale.

That is rather an unreasonable request, after such a long conversation, which it is now time to conclude. The dinner bell has rung; we must attend its summons.

DIALOGUE

DIALOGUE XIII.

THE PROGRESS OF SOCIETY.

Mrs. Dimsdale.

Lucy, let me look at your work: you do not appear to have made much advancement.

Lucy.

I should have done a great deal more, but, to confess the truth, my attention has been engaged with considering what stupid people those South-Sea islanders are, about whom you read yesterday, to be contented with such inconvenient huts, when they might be more comfortable by building houses like ours, and furnishing them as we do.

Mrs. Dimsdale.

Numberless arts, of which they are wholly ignorant, are requisite to complete a well furnished European house. Besides, many of

of the materials that compose the furniture, and parts of the building, are the produce of distant countries, and can only be obtained by foreign commerce, which requires ships of considerable magnitude, and skill in navigation, to conduct them across the wide ocean.

Emily.

But why do not these people build ships, and learn navigation?

Mrs. Dimsdale.

Because they are not yet sufficiently advanced in knowledge to qualify them for the exercise of such arts. The progress of science is extremely slow. All nations, (except the descendants of Abraham, who received a revelation from heaven concerning their religious duty,) were originally savages: some became sooner civilized than others, according to the different circumstances of their situation. Before agriculture, and other useful arts, were understood, the difficulty of obtaining food to satisfy hunger, clothing for decency and warmth, with an habitation for shelter, was so great, that probably no further

accommodations

accommodations were sought by men in the first ages.

Lucy.

If they had no shops, where could they procure food and clothing?

Mrs. Dimsdale.

Every man provided for himself, without depending, as we do now, upon the assistance of others. He built his own hut, and sewed the skins of the beasts together, that he caught, for clothes. The land belonged to the whole community; no part of it was the property of one person more than of another. In temperate, warm climates, the fruits of the earth that grew without culture, and the flesh of wild animals, afforded a sufficient supply of food, whilst there were but few people. Hunting was then their principal employment; and the dexterity it required, served to strengthen their bodies and sharpen their invention: but as men increased, animals became scarce and shy, and necessity compelled them to find some more certain means of supply. A fawn, a kid, or a lamb taken alive

alive, and tamed for amusement, might give the first hint for rearing herds of tame cattle. Finding the care of their flocks an easier and pleasanter employment than rambling about the woods in search of game, and that their milk and flesh yielded a more regular subsistence than the precarious supply of hunting, men gradually changed from the condition of hunters to that of shepherds.

Lucy.

They could not live upon meat and milk alone: how did they contrive to make bread?

Mrs. Dimsdale.

It was a long time before they arrived at that art. Corn, like the other productions of the earth, was found scattered about in wild profusion. Men tasted the seeds, and perceiving that they were agreeable, nourishing food, eat so plentifully of them that they became very scarce: want taught them to sow the seeds, and by gradual improvement to cultivate the ground every season, till they obtained regular harvests. Thus, from mere shepherds they were converted into farmers.

Forests were cut down, woods cleared, the earth tilled, towns built; and, in process of time, ships constructed, the ocean crossed, and an intercourse between distant nations established.

Emily.

Do all nations make their bread of corn?

Mrs. Dimsdale.

No; many other substitutes have been used in different countries. The native Americans eat the root of the cassava, ground to powder and made into cakes: and the Laplanders, at this day, are contented with grinding the bark of trees for that purpose. Rice, which indeed may be considered as a species of corn, forms the principal food of the Chinese, and many other nations that inhabit warm climates.

Lucy.

How highly his countrymen must have respected the person who first thought of grinding the grain into flour, and afterwards making it into paste.

Mrs.

Mrs. Dimsdale.

The inventors of useful arts were regarded with such veneration in the days of ignorance, that many of them, after their death, had divine honours paid to their memory: temples were built, and priests appointed to offer sacrifices to them. From a desire of ennobling these public benefactors, many stories, partly true and partly fabulous, were related of them. Dædalus, the supposed inventor of sails, was said to have escaped from the anger of Minos, king of Crete, by means of wings of his own making: Bacchus is said to have discovered the art of converting the juice of the grape into wine; and Scythos, son of Jupiter, to have invented the bow and arrow. Spinning was so useful an invention, that it was attributed, in different countries, either to a female deity, or to some woman of the highest rank. The Egyptians ascribed it to their goddess Isis; the Greeks to Minerva; the Persians to Mama Ella, a queen, whom they believed to be of divine descent; and the Chinese to the wife of their emperor Yao. Ceres

is thought to have invented the plough, and she was dignified with the title of goddess of harvests and corn fields, as a reward for her ingenuity. From this kind of gratitude arose the worship of the numerous divinities of Greece and Rome, and other Pagan nations; which continued till men became more enlightened, and transferred their adoration to its only proper object, the true and living God, Creator of heaven and earth.

Emily.

They must have been grossly ignorant indeed, to have attributed divine power to men and women after they were dead, however useful they were when living.

Mrs. Dimsdale.

When men first began to live together in communities, they had neither time nor means for acquiring knowledge: their chief care was to procure food for the day, and shelter for the night. Any one amongst them, therefore, who had greater abilities than the rest, and was the inventor of a useful art, or a machine that shortened their labour in procuring

curing food, was regarded as a being of a superior order; and when he died, gratitude induced them to honour his memory with feasts and ceremonies, which were afterwards corrupted into a sort of homage.

Lucy.

What motive led men to unite together? since, while they lived separately, every man was his own master, and possessed all things around him: but as soon as they formed a nation, they were obliged to obey the laws, and share the land and the fruits with others.

Mrs. Dimsdale.

In the first place, the love of associating with his kind is natural to man, who is a herding, and not a solitary animal. The difficulty of subsisting alone, and of repelling the attacks of wild beasts, were also powerful reasons for a few, who inhabited the same district, to form a society amongst themselves. When, by the increase of their families, they had become a numerous tribe, they found it necessary for the good of the

whole, to give up a little of their independence, and submit to some regulations, to prevent one from injuring another. At first, the woods in which they hunted, and the lands where they dwelt, belonged to the community; but after they had learned to cultivate the ground, they perceived that the idle enjoyed the same benefits as the industrious, by possessing things in common. Justice required that this inconvenience should be remedied: nothing was so effectual as obliging every man to support his family by his own labour. The land was divided, and each man became owner of the spot he cultivated; and, probably, his son inherited it, with his tools and household utensils.

Emily.

If the land was divided into equal parts, how came some people to be rich and others poor?

Lucy.

Do not you know, that in all countries, some are more virtuous and wiser than others; of

of course, they would succeed better than their neighbours.

Emily.

That is true; but still their land would remain the same.

Mrs. Dimsdale.

So far from it, that when an indolent or stupid man had neglected to till his field, or had managed his crop so badly that it did not yield enough for his support, he was obliged to sell part, or perhaps the whole, of the land allotted to him, to one whose harvest was sufficient for them both. The man who had thus doubled his estate, was not able to cultivate so large a piece of ground by himself; and necessity obliged those who had so foolishly lost their land, to work for others for the sake of a maintenance: hence arose the distinction of master and servant. Ingenuity in exercising the useful arts of building houses, making clothes or furniture, or dexterity in catching game, would likewise give one man great superiority over others less skilful; the most laborious tasks would fall to the lot of those

those who were least qualified for employments that required contrivance: scarcely any talent but bodily strength is wanted for digging the earth, or carrying heavy loads.

Lucy.

I see plainly that the wisest amongst savages will always be the most powerful; but I cannot imagine how they ever consented to let one man govern all the rest. The first king must have been very artful, to have persuaded his countrymen to submit to him in every thing.

Mrs. Dimsdale.

When neighbouring tribes fell out, which soon happened, from various causes, wars followed; and the necessity of a chief, to lead them to battle, obliged them to appoint the most courageous and experienced person amongst them to command the others. If he was so fortunate as to succeed in his enterprize, he sometimes retained his authority; at least it gave him great influence in the councils, which were held amongst the elders of the nation: and there are many instances in the

the history of men, in the early ages, who, from ambition, or the desire of improving the condition of their countrymen, obtained the sovereignty, by forming a code of laws, which they pretended had been revealed to them by some divinity, as you may remember Numa did, in order to persuade the Romans to obey his institutions; by which you may perceive that the royal authority was sometimes gained by stratagem; but it was mostly for the advantage of the people, who, without some sort of government, must have always remained savages.

Lucy.

Were all nations first governed by kings?

Mrs. Dimsdale.

No; different circumstances produced various forms of government. Many, as we have already remarked, chose some favourite individual—a fortunate general, or a wise legislator, to rule over them. The affairs of other nations were conducted by a council of the elders, or wise men, which is called an aristocracy; and, as society advanced, and the

the difference of rank became more distinct, this council was frequently composed of the nobles, instead of being confined to those whose superior wisdom gave them a claim to this pre-eminence. Other tribes, unwilling to resign the power of governing themselves, deliberated on affairs of state in an assembly of the people, which is called a democracy, and is the worst of all the different species of government.

Emily.

But it seems very unfair to exclude the people from some management of their own concerns, since it is for their benefit only that there is any occasion to form a government.

Mrs. Dimsdale.

The happiest system of conducting the public affairs of a nation, is by that mode of government called representative, in which the people choose persons of intelligence to act for them; and in case of abusing this power, have an opportunity of rejecting them at a future election. A representative government may be

be either aristocratical or monarchical: that is, it may have a monarch at the head of it, as is the case with the British government; from which it reaps great advantages, in many respects, above your comprehension at present.

Lucy.

I wish you would take the trouble of pointing out to us what arts men first invented, and how they attained such perfection in making so great a variety of things as we see in the shops every time we go to London.

Mrs. Dimsdale.

It is too late to begin so copious a subject. You have worked long enough: we will now take a turn in the garden, and renew this conversation at a more suitable opportunity.

DIALOGUE

DIALOGUE XIV.

THE PROGRESS OF ART.

Emily.

MAMMA, we have a favour to ask.

Mrs. Dimsdale.

What is it? If it be a request proper to be granted, you are sure of my consent; but if you are conscious that it is otherwise, do not put me to the pain of a refusal.

Emily.

It is only to excuse our evening walk, and instead of it, to sit with us on the white bench, on the top of the hill, and tell us how the savages tribes improved, and learned such a vast number of useful arts.

Mrs. Dimsdale.

As the evening is so very hot, and you seem tired with running about the garden, I think I must comply.

Lucy.

Lucy.

That is very kind, my dear indulgent mamma. I long to know which was the first country that became civilized: I suppose it was some part of Europe; and, most likely, England.

Mrs. Dimsdale.

You are very partial to your native island: but a warmer climate, and a more fertile soil than England would be without cultivation, were necessary for the early progress of the arts. It is reasonable to suppose, that where the earth produced plenty of food with scarcely any culture, men would have the most leisure for contriving comfortable accommodations; accordingly, history informs us, that the arts flourished early in Egypt, Chaldea, and Greece. From the old proverb we learn that "necessity is the mother of invention." The danger of being overrun and devoured by beasts of prey, very soon exercised the ingenuity of the first inhabitants of the earth, to contrive bows and arrows, and other weapons, with snares of different kinds, to enable them

to diminish the number of these formidable enemies. As soon as they were secure, and had a sufficient supply of food, they began to turn their thoughts to making their dwellings more commodious, and to clothing themselves with greater neatness and conveniency.

Emily.

I suppose the first hut that had a chimney and windows was reckoned a palace.

Mrs. Dimsdale.

They were certainly great improvements: others were suggested by the inconvenience of particular situations: a damp soil might induce them to think of laying floors, and raising one story above another; a stormy climate probably taught the advantage of digging foundations, and strengthening their mud walls with wood work. Scarcity of timber might compel them to use clay, which ingenuity converted into bricks, by dividing it into pieces of convenient size, and baking them in the sun. Thus, different modes of building were adopted in different countries, according to the circumstances and produce of

of each: Sweden, for example, abounds with forests, and most of the houses are built with logs of wood, piled on one another; Italy produces variety of the richest marbles, which supply a durable material for their churches and chapels. Where there is not plenty of marble, or timber, the people are contented with brick houses, as clay is generally to be found. Architecture, like most other arts, was long in attaining perfection; but it was advanced by the universal desire men feel for ornamenting their temples, and the places where they inter the dead bodies of their friends: for in all countries, places of worship, and the tombs of distinguished persons, have been decorated with the utmost skill of the inhabitants.

Lucy.

Men could not possibly make very handsome houses, till they had discovered iron, and found out the art of making it into saws, hatchets, knives, and other tools.

Mrs. Dimsdale.

That is well observed; the discovery of the

metals, and iron espcially, hastened the progress of civilization, wherever it happened: indeed no nation could advance far in the arts without the assistance of iron. It is likely that accident first brought to light these hidden treasures, which have been of such vast benefit to mankind.

Emily.

They seem to me to have done almost as much mischief as good, for if the ancient history we are reading be true, thousands, and tens of thousands of men, have been destroyed by swords and warlike instruments made of iron.

Mrs. Dimsdale.

The best gifts of our bountiful Creator may be perverted to improper uses, by the unrestrained passions of men. Revenge for injuries received, by private persons or tribes, gave occasion for the early invention of such weapons as clubs and darts. Those who were attacked were obliged to provide for their own safety, by contriving means of defence. Trunks of trees, interlaced with branches, and

supported

supported with earth, made the first fortifications. As architecture was improved, towns were often surrounded with walls of considerable strength, which could only be demolished by a machine, used by the ancients, called a battering ram; which was rendered useless, by digging a very deep, broad ditch, on the outside of the wall. The fortifications being thus put out of the reach of the enemy, those who defended them could only be attacked with stones or javelins, hurled at a distance, from engines constructed so as to throw them with great force. In this manner men made war, by different contrivances of attack and defence, till a German monk, about the year 1330, discovered the art of making gunpowder, which changed the whole military system, and is thought a vast improvement in the destructive science of war.

Emily.

I would sooner have found out something to save men's lives, than to destroy them.

Lucy.

It would have made me happy to have been the inventor of the plough, the harrow, or the loom: but for gunpowder, the reflection would have destroyed my peace as long as I had lived.

Mrs. Dimsdale.

The inventor was probably a chymist, who did not foresee the consequences of his discovery.

Lucy.

Who had the honour of first contriving to build a ship, and venturing in it across the ocean?

Mrs. Dimsdale.

No single man could claim that distinction. Innumerable improvements intervened between the cautious attempts of the early inhabitants of sea coasts, on rafts and canoes, hollowed out of the bodies of trees; and the attainment of a complete ship, full rigged, and furnished not only with all kinds of domestic accommodations, but also with an instrument that directs the mariners with certainty

tainty to find their way from one country to another.

Emily.

What can that be? It has always puzzled me to guess how my uncle could find the way to the East Indies, especially in the night; and after thinking of it a great while, I supposed that he was directed by attentively observing the course of the stars.

Mrs. Dimsdale.

Before the invention of the mariners' compass, which is the instrument I mean, the stars were their only guide. The curious property of the loadstone, which, if at liberty to move, always points towards the North, was first applied to this purpose, in Europe, by a person named Flaveo, about the year 1302; but it is said that the Chinese had made use of this ingenious expedient long before, for the same purpose.

Lucy.

Astronomy must have been understood, then, before navigation.

Mrs.

Mrs. Dimsdale.

Observation and leisure produced the sciences and the ornamental arts. The first cares of mankind were to supply the urgent wants of necessity; but as soon as they were fully satisfied, the active powers of the human understanding were employed in considering the objects of nature, and applying them to beneficial purposes. One man spent all the time he could spare in observing the motions of the heavenly bodies; another enquired into the properties and habits of animals; a third chose for his pursuit vegetables, and the cultivation of soils: hence arose astronomy, natural history, and agriculture. Experience taught the cure of diseases; and, assisted by reflection, promoted every branch of knowledge, an instance of which I will give you: Thales, one of the seven wise men of Greece, was desirous of measuring the height of an Egyptian Pyramid, but as geometry had not made much progress, he had no rule to direct him, and was a long time contriving expedients before he could effect his design. One day,

day, accidentally observing, that just at that moment his shadow was the exact length of his body, it occurred to him that the shadow of the pyramid, at the same height of the sun, would give the measure of it; accordingly, he watched the next day for a proper opportunity, and succeeded to his wish. The persons who were of a studious turn of mind communicated their discoveries to each other, and, by their mutual labour, increased the common stock of knowledge.

Lucy.

How could they remember what they had learned, till they knew how to put it down in writing.

Mrs. Dimsdale.

The Egyptians, who very early excelled most nations in learning and ingenuity, contrived a particular species of writing, called hieroglyphics. It represented the idea they meant to express, by a figure that had some affinity to it: thus, a circle signified eternity, because it had neither beginning nor end; a lion denoted strength; a bullock agriculture;

and

and a horse liberty. The Mexicans, a nation in North America, communicated their ideas in a manner somewhat similar. Montezuma, the emperor, received intelligence of the arrival of the Spaniards, when they discovered that country, by pictures made of painted feathers. The Peruvians, a people not very distant from the Mexicans, made use of knots, of different colours, instead of figures, in casting up their accounts. But this picture-writing is by no means so convenient, or comprehensive, as our method of representing the sounds that compose our words by letters, which express the same sound in whatever word it occurs. It would only suit a people whose ideas were confined to a few simple objects. As knowledge increased, it became necessary to invent a method of more easy attainment, and capable of expressing the multiplicity of ideas that arose from the numerous branches of science and art.

Emily.

After letters were contrived, there were many things wanting that required great ingenuity, before

before writing and books could be as common as they are now—paper, pens, ink, printing, and bookbinding.

Lucy.

Grammar and spelling would be still more difficult; and yet, without some rules of that kind, writing would be as unintelligible as the confusion of languages at the building of the tower of Babel.

Mrs. Dimsdale.

A vast number of years must pass in bringing both the order of language, and the materials that compose books, to the perfection in which we enjoy them. Amongst the ancient Britons, and many other nations, in the early periods of society, was a set of men called bards, whose office it was to recite verses at feasts and public assemblies, containing the heroic actions of their kings and great men; battles, and other historical events; with the principles of their religion, and maxims for the conduct of life. The bards spent their youth in learning, by heart, these poems, in which were comprised all the knowledge of their

their countrymen. These living oracles of wisdom, in some degree supplied the want of books; but no very extensive range of science could be spread amongst a people by this device. All the learning of the times was confined to the bards, which gave them great authority, and rendered their persons sacred. The bulk of the people remained in ignorance, and consequently could not advance far in civilization, till that happy period arrived, when the invention of letters received its highest improvement, by the discovery of the art of printing, which made books cheap, diffused knowledge, and enlightened mankind. Since that time, science in general has advanced with hasty steps; the manners of all ranks are improved, the principles of religion are better understood, and morality is more generally practised. For knowledge and virtue generally attend each other:—vice and ignorance are inseparable companions. Such are the important advantages received from this simple contrivance, that far more gratitude is due to the memory of the inventor, than

than to the discoverer of all the gold mines in the world. But the subject has so much interested me, I have forgotten the time of the evening:—the dews fall; we must go in.

Lucy.

Pray stay another quarter of an hour: I have twenty questions to ask.

Mrs. Dimsdale.

It grows quite damp: you must restrain your curiosity till another opportunity.

THE END.

Printed by Darton, Harvey, and Co.
Gracechurch-Street, London.

PUBLISHED BY

DARTON, HARVEY, AND DARTON,

55, *Gracechurch-Street*,

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