



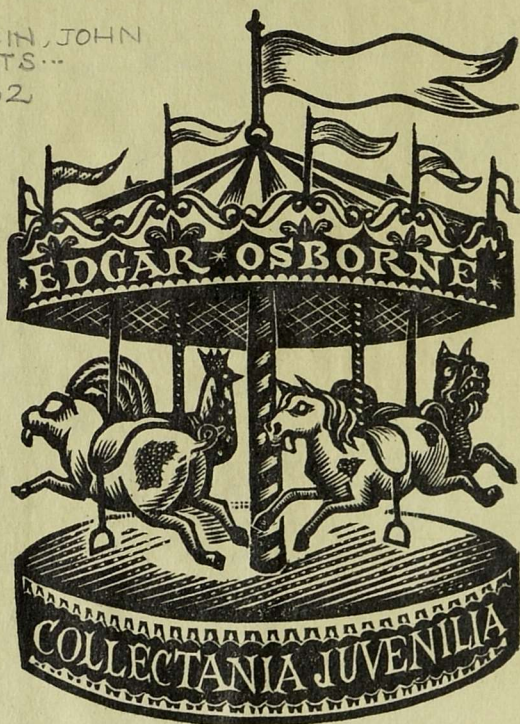
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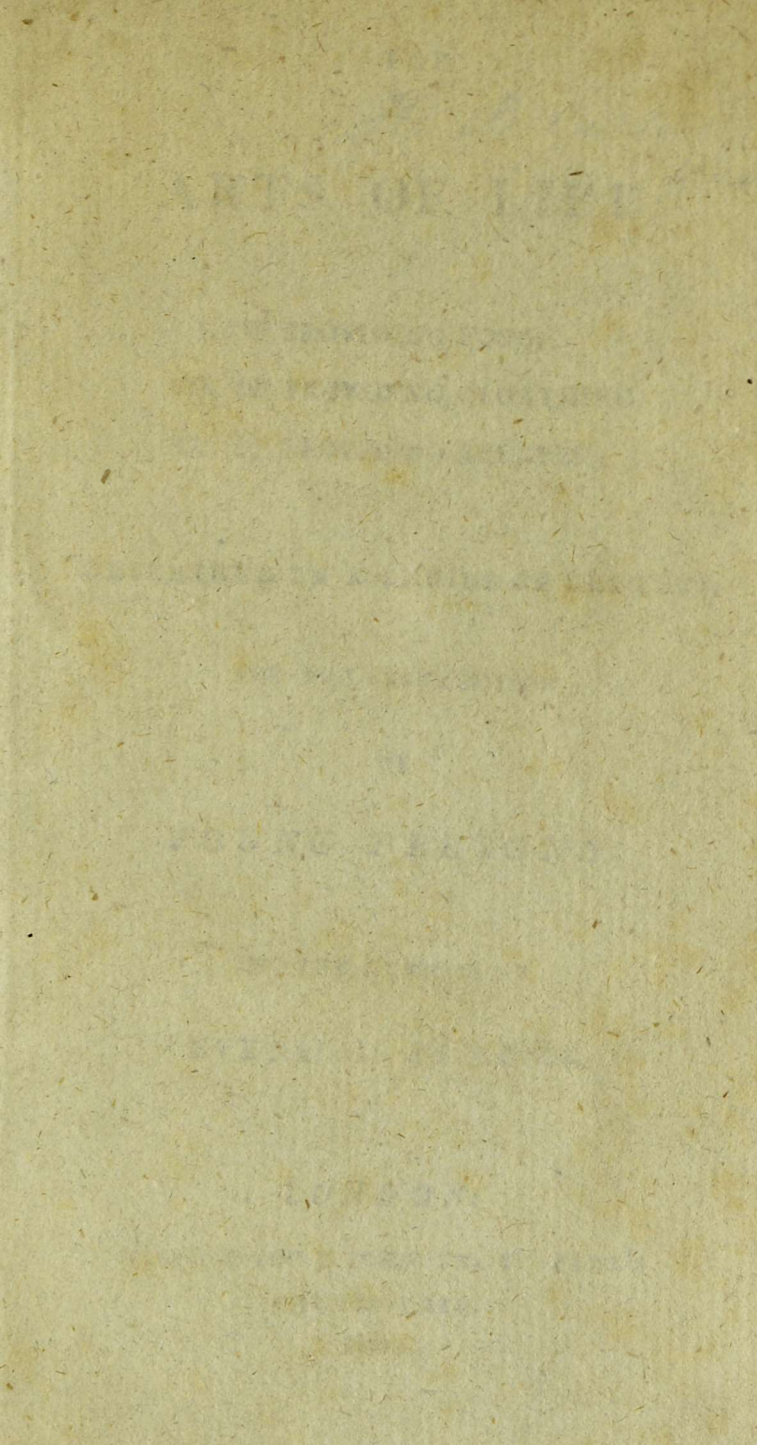
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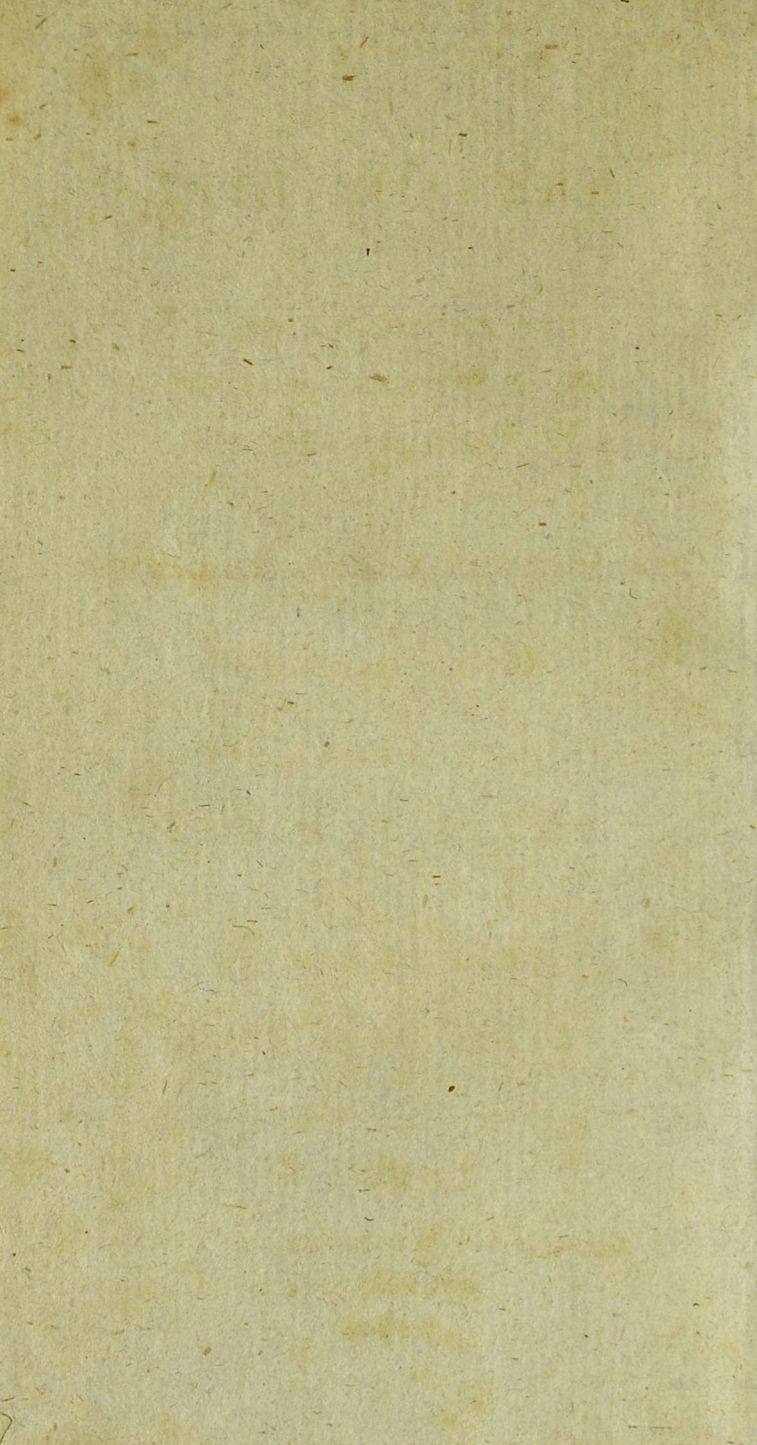
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THE
H. B. Curtis,
ARTS OF LIFE: ^{1804.}

- I. OF PROVIDING FOOD,
- II. OF PROVIDING CLOATHING,
- III. OF PROVIDING SHELTER;

DESCRIBED IN A SERIES OF LETTERS.

FOR THE INSTRUCTION

OF

YOUNG PERSONS:

BY THE AUTHOR OF

EVENINGS AT HOME.

LONDON:

PRINTED FOR J. JOHNSON, ST. PAUL'S
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TAYLOR and WILKS, Printers,
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THE
ARTS OF LIFE
DESCRIBED IN A
SERIES OF LETTERS.

LETTER I.
INTRODUCTORY.

My dear Boy,

THOUGH you are now a stout active fellow, and can work in your garden, and do a variety of things besides playing, yet I think you must have some recollection of the time when you were a helpless little infant, fit for nothing but to be fed and dressed by your nurse. You must probably have observed, too, that the very young animals of other kinds are, for the most part, unable to shift for themselves, and would soon perish without the care of their parents. Puppies

and kittens, you know, are blind when they come into the world, and their limbs are so weak, that they can but just crawl about. Unfledged birds are only fit to lie in the nest, and open their mouths when the old ones bring them food. But all these animals, when grown to a tolerable size, are able to get their living in the way that nature intended for them; and no one ever knew them die of hunger or cold for want of sufficient skill to procure themselves provision or shelter, where they were to be had.

But it is not so with MAN. He not only comes into the world the most feeble and naked of all young creatures, but, after he has acquired the proper use of his limbs and senses, he is very unequal to the task of providing himself with necessaries, unless taught by those who have already enjoyed the benefit of experience. And even if he can make a shift to keep himself

himself alive, it is often several generations before he finds out what can best contribute to his comfort and convenience. In many climates there are no fruits or other vegetable products growing wild which will serve him for wholesome food, at least without some preparation. He can seldom overtake quadrupeds or birds, or catch fish, by his mere bodily powers, unaided by some contrivance. He never acquires from nature, as all other creatures do, a covering for his body sufficient to protect him from the impressions of cold and heat; and caves and woods afford him but an imperfect shelter against the inclemencies of the seasons. The use of fire, which is in many ways so necessary to him, is not taught him by instinct, but must have been learned by practice and observation. For every thing valuable, therefore, man is indebted to *art*; and the first use of his reason is to suggest to him such

arts as are most essential to his welfare.

It is these *arts* that I mean to make the subject of a set of letters to you. For although, in the state of society in which we live, persons of the superior ranks are seldom called upon to exercise the common arts of life themselves, yet I consider it as unworthy of a man so far to rely upon the exertions of others, as to sit down contented with the utter inability of subsisting himself a single day without help. Many are the instances of travellers by sea and land being thrown into situations in which they must provide for themselves, or perish. In such cases, how precious to them would be a little knowledge of those arts, which they may perhaps have disdained as beneath their notice! What would a mere scholar or fine gentleman have done in the place of Alexander Selkirk, when left alone in the island of
Juan

Juan Fernandez? In the times of antiquity, the inventors or importers of useful arts have been treated with divine honours; and indeed what greater human benefactor can be conceived, than one who, coming among a savage people, scarcely able to subsist in want and wretchedness, should teach them the means of acquiring comfort and plenty?

The arts of life may be divided into those, 1st, absolutely necessary for its preservation: 2dly, conducive to comfort and convenience: 3dly, ministering to luxury or pleasure. It is the first two to which I shall confine myself in these letters; and as it is not possible to draw any exact limits between them, I shall not attempt to make the separation, but at the same time shall consider the means both of *being* and of *well-being*. A more useful order to follow, will be that of the particular purpose of these arts; such as the pro-

viding of food, clothing, lodging, and the like. My next letter will make a beginning of these topics; meanwhile, my young friend, farewell, and continue to love

Your truly affectionate

J. A.

LETTER II.

ON THE ARTS RELATIVE TO FOOD.

As I suppose, my dear, you are impatient to be taught *how you might live by yourself*, I lose no time in making a commencement of my proposed instructions. I begin with FOOD, as the article which may justly claim a precedence over others, since it is the first thing supplied by nature herself to the new-born animal, and satisfies the most urgent of his wants.

I believe I need say little to a school-boy on the importance of a plentiful supply of food. It may, however, be of advantage to you to be told that the *proper use* of food to the animal frame is to make up for that waste of solid and fluid parts which constantly

goes on as long as life endures ; and that the *desire* for food is owing to an uneasy sensation in the stomach, produced by the gnawing or corroding properties of a liquor formed there, which, for want of other matter to act upon, preys upon the empty stomach itself. This is fair honest *hunger*, a painful feeling, but serving the useful purpose of exciting us to the procuring of a regular supply of what is necessary to life. You are not to suppose, however, that going without a meal or two will do you any lasting harm. The stomach gives early warning of its wants, but it may be taught patience ; and in many employments and modes of life the intervals of abstinence must frequently be long. Some of the savage hunter-tribes often undergo fasting for days together, in pursuit of their prey. In such cases it is said that they blunt the sense of hunger by squeezing the stomach between two boards

boards bound tightly together ; but this is one of the *arts of life* which I hope you will have no occasion to practise. It is a proof of the benevolence of our Creator, that the necessary action of taking food should not only free us from a pain, but should be a source of pleasure. This is produced by means of the sense of *taste*, the principal seat of which is the palate or roof of the mouth ; and it may in general be taken for a rule, that the same things which are agreeable to the taste, are proper articles of food. But this maxim is to be understood with moderation, for things are not wholesome in proportion to the pleasure they give. There is, besides, danger lest, by indulging too much the gratification of the palate, we should acquire a *false hunger*, which may urge us to eat when the stomach itself requires no supply, but is already loaded with food. Nothing is a more common cause of dis-

order, especially among young people, than giving way to a false appetite of this kind. It may be held for an undoubted rule, that whenever the desire of eating is not gratified by plain and common food, it is no real want, but the craving of a pampered and vitiated appetite.

But now to our proper subject. We will begin with mentioning what are the substances that afford proper sustenance to man; and then consider how they are to be procured.

The two great divisions of food are into *vegetable* and *animal*. Man can subsist upon either of these alone, but better upon both together. Many other animals, likewise, can accommodate themselves to both sorts of food, though most of them, by choice, take to one alone. Thus it is usual to class beasts and birds under the heads of *carnivorous* (flesh-eaters), *herbivorous* (herb- or grass-eaters), and *granivorous* (feed-

(feed- or grain-eaters). But as for man, he may be termed *omnivorous* (an all-eater); in which privilege no creature more shares with him than the hog. They who judge by the teeth of an animal what food is most suitable to him, find that man partakes of all the three classes above mentioned; for he has cutting teeth, piercing teeth, and grinders, and can equally manage food of a soft and a hard texture.

Vegetable food is that, which, in most countries, constitutes the greater part of man's sustenance. It is nearest at hand, procurable in greatest quantity, and with most certainty, and upon the whole is the wholesomest. Of vegetables, by which I mean all kinds of plants, the earth is full, and the varieties of them seem to be endless. Almost all of them are food to some animals, and many more than is commonly imagined might be made to yield food to man. Different as they
B 6 appear,

appear, the proper matter of food which they contain is nearly the same in many species, and may be classed under a few heads.

That vegetable substance which is the chief matter of human aliment, and is found in the greater number of the articles commonly used for food, is called the *farinaceous*, from *farina*, the Latin word for *meal*. This, in its separate state, is white, powdery, of little taste or smell, capable of swelling with water and thickening it, and of being kneaded or worked into cakes. It contains a part called *starch*, which will dissolve in water, and make a jelly with it, as you have doubtless seen in the laundry; but this starchy part is not only useful to stiffen linen, but is that in which the nourishment of the meal chiefly consists. There is scarcely any vegetable which does not contain farinaceous matter in some part of it; but in many, this portion is so small,
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and mixed with so much useless or hurtful matter, that they are unfit for human food. Men, therefore, have from the earliest times employed themselves in searching which of them yielded the most of this substance, and in the purest state; and they have usually made some of these vegetables the staple article of their diet. I will now mention some of the principal of them.

Those grains which are called *corn*, and which are the seeds of certain plants of the grass-tribe, are the great source of farinaceous food in almost all the civilized countries of the globe. These are not known any where to be the natural products of the earth, but are the reward of human industry in cultivation. They must, indeed, originally have existed in a wild state; but it is a great number of ages since man has taken them for his use, and improved and multiplied them by culture.

ture. You know that, in the Bible, which is the oldest record of the history of mankind, mention is frequently made of corn as the great article of sustenance; and when the family of the patriarch Jacob were reduced to great distress from years of scarcity, they went into the fertile land of Egypt to purchase corn. The kinds usually grown in the temperate climates are wheat, rye, barley and oats; in the warmer countries there are also rice, maize or Indian corn, millet, and some others. All these have a chaffy head, beset with a number of seeds, each enclosed in a separate husk. When they are detached from their husks, they are found to consist of a thinner skin, within which is a white substance or kernel, formed entirely of what, when reduced to powder, becomes farina, or meal. Some of these grains are more palatable or more nourishing than others; but all are fit

for man's food. They may be used whole, only taking off the husk or skin; and thus, you know, rice is commonly eaten, after being softened by boiling or baking. Shelled barley, and oats called groats, are sometimes used in the same manner. It has, however, been more usual to grind them into a powder, more or less fine, and knead it into dough or paste, to be afterwards cooked; but the arts by which this is done will more properly be described hereafter.

Various other seeds contain enough of farinaceous matter to be useful as food. Of these are many of the leguminous or podded vegetables, such as beans, peas, kidney-beans, and the like. Their seeds, when ripe and dry, are very mealy, as I dare say you know, by the experience of pease-pudding to boiled pork. In seasons of scarcity, the bread of the poor is often mixed with a proportion of bean- or pea-meal,

meal, which makes it coarser and less palatable, indeed, but not less nourishing. With us, however, these seeds are more commonly eaten in a green and unripe state ; and they are the food of domestic animals when dry.

The chesnut is another seed abounding in farinaceous matter, so as to be one of the articles of which bread is made in the south of Europe. The chesnut in England seldom comes to maturity, and those brought to our tables are imported as a sort of delicacy. But in Spain there are whole woods of them, which afford the poor great part of their sustenance. The acorns of warm climates, too, are fit for human food ; and the poets tell us that they were the first vegetable article made use of by man in his primitive state. They are, however, very indifferent diet ; and it is justly reckoned a great improvement, when the culture of corn was substituted to “ fighting
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ing the tusky boar for his acorn meal."

Several fruits of the tropical countries yield farinaceous matter in abundance; but none is so remarkable in that respect as the bread-fruit, a product of the happy isles in the South Sea, which is said to have exactly the taste and appearance of the crumb of a new roll. By means of this kind gift of nature, a person, with the easy labour of planting a succession of these trees, may provide bread for his whole life, scarcely by "the sweat of his brow."

The roots of plants are another copious source of farinaceous nutriment. Most of those which swell into a round form, called a *bulb*, or which run down straight and thick, contain a portion of this matter, though often mixed with juices of another kind. We have the happiness in this country of being well acquainted with, perhaps,

haps, the most valuable root of the farinaceous class that nature has produced—the potatoe. This plant, originally a native of North America, is said to have been first introduced into Europe by the celebrated Sir Walter Raleigh, who cultivated it on his estate in Ireland; whence that country has longer enjoyed the benefit of it than Great Britain. No other root with which we are acquainted so nearly approaches to the quality of grain. A potatoe of the best sort, properly dressed, will break down into an almost perfect meal; and it may be made to yield a considerable quantity of starch, as pure as that from wheat. It likewise affords a vast increase upon culture, and it thence becomes our best resource against scarcity. Some of our other garden roots, as turnips, carrots, and parsnips, owe their nourishing property in part to their farinaceous matter. In South America

is a large root of this kind, the yam, which is often used as bread at table. A remarkable article of this class is the cassava root. This, in its fresh state, contains an extremely virulent poison; but by grating, washing, and drying, this hurtful part is got rid of, and the remainder is a fine meal, much used for making bread. The Indian arrow-root, by a similar preparation, yields a pure nutritious flour, which is sold in our shops as a proper food for weak stomachs.

Another useful farinaceous article is sago. This is a sort of gummy substance, found within the fibres of the stem of a palm-like plant in the East Indies. It is taken out by splitting the stem; is separated from the woody part, by steeping in water; and is then dried, and moulded into cakes or formed into small grains.

But I have now given you enough for one letter; so, for the present, adieu!

LETTER III.

ON VEGETABLE ARTICLES OF FOOD.

My dear Boy,

IN my last letter I gave you a general account of the division of vegetable food, called the farinaceous. I now proceed to inform you what other matter in vegetables is nourishing to man.

The first that I shall mention cannot fail to afford us an agreeable topic. It is the *sugary* or *saccharine* part, which is contained in the juices of so many plants. With us, the sweet juices are chiefly met with in fruits; and those, too, not native fruits, but the foreign products of our gardens. Some of our eatable roots also possess a degree of sweetness; as beet, turnip, parsnip,

parsnip, carrot, and onion ; not to mention liquorice, which is sweeter than any of these, but is scarcely an article of food. Even the farinaceous vegetables acquire a sweet taste when they *grow* or *germinate* ; that is, when the rudiments of a new plant begin to sprout from them. This you may discover in a sprouted potatoe, or in grown corn. Malt, you know, is extremely sweet ; at least, you have probably tasted sweet-wort, which is an infusion of malt in water : but malt is only barley made to germinate artificially, by means of heat and moisture, and then suddenly dried. This shows a close connexion between the sweet and the farinaceous part in vegetables ; and as the latter is nourishing, so is the former. You may take it as a general rule, that all sweet things afford nutriment ; though I would not have you conclude that they are all fit for food, at least without proper mixture with
other

other things. Fruits, with us, are rather used for the pleasure of the taste, and their cooling property, than for the purpose of nourishment ; indeed, the acid or tart juice which they contain with the sweet, opposes their nourishing quality by its effects on the bowels. But in the hot countries, where fruits are often lusciously sweet, they are common articles of food. Grapes, especially in their dried state, when they are called raisins, are commonly used as such ; and figs still more. The date, or fruit of the palm-tree, which is a rich sweet without flavour, makes a large share of the diet of the people of Arabia and part of Africa.

Sugar, peculiarly so called, is the thickened juice of a tall reed named the sugar-cane, growing both in the East and West Indies, and in other warm climates. It contributes to the nourishing quality, as well as to the palatableness, of what it is mixed with ;
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and you know into what a number of agreeable dishes it enters in our cookery. The soft part of the raw sugar-cane is eaten in the countries where it grows ; and it is observed that the negroes employed in the making of sugar, notwithstanding the hardness of their labour, grow fat during the season of that business, in consequence of the quantity of the cane or its juice that they eat. Honey, which is the sweet juice of flowers, extracted from them by the bee, contains much nutriment, though it is apt to disagree when taken in considerable quantity.

If *drink* is to be reckoned a part of food, the class of vegetable sweets ranks high among the substances we are treating of, for it is the basis of all fermented liquors. *Fermentation* is an internal motion or working of a liquor, by which it throws off its thick and foul parts, and becomes clear and bright. All sweet things, when in a fluid

fluid state, if suffered to stand in a moderate degree of heat, undergo fermentation, by which they lose great part of their original taste, and acquire a brisk tartness, very agreeable to the palate, and cheering to the stomach and spirits. It is then properly called a *wine*, though that name has been principally applied to the juice of the grape when brought to this state. But there are besides, you know, the *made wines*, as we call them, of raisins, currants, elder-berries, and various fruits, to which some sugar is usually added. Then there is cyder, or apple-wine; and mead, or honey-wine; and, what in this country is used more than all the rest, malt-liquor, which may be termed barley-wine. To make this, the barley (as I have already mentioned) is rendered sweet by bringing on a sudden germination, which is called *malting* it; and the malt is steeped in hot water to extract its sweet-

sweetness. It is a remarkable circumstance, that scarcely any nation, savage or civilized, has been discovered, which had not found out the art of making some kind of fermented drink. This may seem an argument in favour of their usefulness; but I am apt to suspect that it has been their intoxicating quality, rather than their taste or other properties, which has rendered them such favourites. Could people be contented with the moderate use of them, they might be accounted a valuable addition to diet; but, abused as they are, it might almost be wished that pure water were the only drink known to mankind. The mischief has been made much greater by the discovery of the art of extracting the strongest part of these liquors separate, by means of distillation. The product is then called a *spirituous liquor*, which is in reality a kind of *liquid fire*, which destroys the reason and consumes the

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vitals.

vitals. Certainly, the preparation of this cannot properly be called one of the *arts of life*. A much more innocent product of fermentation is *vinegar*, a sour liquor, into which all sweet liquors turn when they are not made into a perfect wine. This is cooling and refreshing, and forms an agreeable addition to several kinds of food.

Sweet things are apt to pall the appetite; and, by turning sour upon the stomach, to cause great disturbance within. They are particularly hurtful when taken in quantity upon a full meal, which is too often the case at desserts after dinner. Excess in them is the usual intemperance of young people, to whose palates they are particularly agreeable. Thus every pleasure offered by kind nature is turned to a bane, if we have not sufficient self-command to use it with moderation.

Another class of nutritious vegetable products is the *oily*. A great number
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of seeds abound in a mild tasteless oil, which, though unfit for food by itself, adds greatly to the nourishing quality of the substance with which it is mixed. Nuts of all kinds contain this oil; and also the kernels of several fruits. The presence of oil may be known by mashing the substance and then pouring on water, which will become milky if oil makes a part of it. Almond-milk, or emulsion, is made in this manner. The cocoa, which is a great nut growing upon a tall tree in the tropical countries, contains a natural milk, which is a mixture of its oily with its sweet and watery juices. From many oily vegetables the oil may be procured separate by means of simple pressure. Thus it is got from the fruit of the olive, which is the principal source of eating-oil in Europe, and is much cultivated in the southern countries on that account. The seeds of flax, hemp, rape, mustard,

tard, poppy, and several other plants, yield oils by pressure, of a similar kind, but less palatable; whence they are used rather for other purposes than for food. Chocolate, which is so great an article of diet in Spain and South America, and is a luxury with us, is a kind of solid oil or butter, procured from the nuts of the cocoa. Palm-oil, procured from the seeds of a plant growing in the hottest parts of Africa, is used by the natives for the purposes of butter. It is to be observed of the oily vegetables, particularly those of the nut kind, that they are in general difficult of digestion, and liable to do much harm if eaten in large quantities.

Another tribe of vegetables are nutritious by virtue of the *mucilaginous* or slimy juices which they contain. You are probably acquainted with plum-tree and cherry-tree gum, and also with gum-arabic. These are pure mucilage,

mucilage, exuding from the tree, and hardened by the sun and air. It is seldom found in this separate state, but there is perhaps no vegetable whatever without a portion of mucilaginous matter. Those juices which become sweet, oily, or farinaceous, in a mature state, are mucilaginous in an earlier period. Some plants, however, are particularly remarkable for their slimy nature, which they keep without changing. Such are mallow, marshmallow, comfrey-root, linseed, the seed of quinces, and many others. These give out their mucilage to water on boiling, and render it thick. They are articles of medicine rather than food; but it is good to know, on occasion of scarcity, that gum, and all those vegetables which, upon chewing, become slimy in the mouth, will afford an innocent nourishment. The caravans which cross the deserts of Arabia are often loaded with a quantity of

gum-arabic for the use of manufacturers ; but when in want of provisions, they have sustained life many days by employing the gum as food. Some poor people who dwell on the sea-shore in cold countries obtain food from certain kinds of sea-weed which abound in mucilage ; and the Icelanders, in their inhospitable climate, derive great help from a kind of lichen or liver-wort, a leathery sort of substance growing on the ground, which yields a strong jelly when boiled in water or milk.

I believe I have now mentioned all the principal articles of vegetable food presented to us by nature. You see they are very numerous, and many of them easy to be procured ; so that it would seem there is little danger of absolutely starving in a climate and soil where plants grow in profusion. But a mere casual subsistence would never provide for a considerable population,

lation, and is, besides, subject to much uncertainty and inconvenience. Human art, therefore, has in all countries employed certain methods to secure and improve these gifts of providence. What these are, will make the subject of my future letters. But these will require some time to prepare; so, at present, farewell!

LETTER IV.

ON AGRICULTURE.

PERHAPS you may have thought that I have kept you too long upon introductory topics ; but it was proper to lay a foundation in *nature* before coming to *art* ; for nature must always furnish the material upon which art is to operate. I shall now, however, immediately proceed to describe the earliest and noblest art of all, that of AGRICULTURE, or the CULTIVATION OF THE SOIL. I call it the *earliest*, presuming that man was originally placed in some happy climate, adapted to the growth of vegetables, whence he was led to make choice of vegetable food in preference to animal, and to attend to its renewal as fast as his consumption

sumption destroyed it. You know that the most antient record we have of the human race, represents the first man and woman as placed in a garden, which it was their business to till. I also call this art the *noblest*, because it is the most useful of all, and that which is the foundation of all the rest; for where plenty of food is produced, man will infallibly multiply, and will employ his inventive faculties to supply his other wants; but scarcity of food acts as a deadly disease upon society, and cramps every exertion. The Chinese have been so sensible of this truth, that they have considered every thing else as subordinate to the culture of the land; and, though abundantly ingenious in many other arts, hold them all mean in comparison with that. In order to do it honour, the emperor himself, surrounded with all his great officers of state, on a certain day of the year plows a piece of ground with

his own hand, and sows it with grain ; the produce of which is carefully collected, and its quantity registered, as one of the most important events of the year.

The business of agriculture consists in the selecting of such vegetables as are useful for the purposes of life ; freeing them from the incumbrance of weeds ; promoting their growth by a proper working of the soil, by the use of manure, and by all the other means which experience has found serviceable to that end ; and, finally, gathering them in their due season. I shall mention all these different operations in their order ; first remarking that I consider *gardening* as a part of agriculture.

The choice of the article to be cultivated depends upon such a previous knowledge of the nature of vegetables as I have attempted to give you in my former letters, and also upon the experience

perience of their suitableness to different soils and situations. Supposing this determined, the next thing is to prepare the ground for its reception. In order to allow plants to strike root freely, the land must be loosened and broken into small particles, and at the same time cleared from the useless plants, or weeds, already growing upon it. Hence, the plough and the spade are the first instruments of agriculture. The plough, by means of its share or coulter, cuts through and turns over the soil over which it is drawn. It buries the upper surface, with the weeds, and brings up fresh mould from below. The weeds, thus uprooted and turned under, die and rot, and serve to enrich the soil; while the earth brought to the top is exposed to the action of the sun and air, the dew, rain and snow, which serves to fertilize it, and render it soft and mellow. Plowing is repeated several times

in stubborn soils ; and after it has done its work, comes the harrow, which, with its iron teeth, still further breaks the clods. Heavy rollers are also sometimes drawn over, to complete the operation. What is done by these in the field, is more neatly performed in the garden by the spade, hoe, and rake ; but these instruments do their work more slowly, and are managed by men's hands alone ; whereas horses and oxen are fellow-labourers with man in the more expeditious culture of the field. Where the land is of a spongy nature, and over-abounding in moisture, it is necessary to drain it before it is tilled. This is done by cutting deep trenches through it in several directions, and covering them over with flat stones or fods.

Little needs be said as to the necessity of fencing cultivated land against the inroads of cattle, or other plunderers. This is done either by ditches, banks, rails,

rails, and stone walls, or by live hedges of strong and prickly shrubs. It is chiefly owing to the frequency of green hedges, interspersed with trees, in the enclosed parts of England, that its prospects are so peculiarly rich to the eye. Hedges have the bad property of harbouring a great number of small birds and vermin, which prey upon the grain; but in return they break the force of the storms, and yield faggot-wood for fuel.

Before countries were fully peopled, while land was yet plentiful, it was the usual custom to select those pieces of soil which were naturally best adapted to the purposes of agriculture, and to leave the rest in a wild and uncultivated state, such as we now see it in the heaths and commons, which are scattered through even the finest parts of England. The better sort of land was then trusted to its own fertility, and nothing was done to it but the kind

kind of tillage above described. When it no longer yielded such an increase as to make it worth while to expend labour and seed upon it, the land was considered as tired or exhausted, and was left to repose, and to recruit itself by the influence of the elements. This practice was called *fallowing*; and by its means tolerable crops of grain were obtained about two years in three. But in process of time, land becoming more valuable, it was desirable both to force it to bear without any interval of rest, and to bring into some kind of cultivation even the poor and refuse parts which had before been neglected. This could only be effected by the use of *manure*, the proper application of which has become one of the most important points in the art of husbandry.

Manures are of many kinds, and are employed with various intentions. In the larger way they are used to
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change the very substance and staple of the soil. Thus, lands consisting of mere sand are improved by the mixture of a large proportion of *marl*, a kind of earth, the ingredients of which are clay and calcareous earth. This binds the particles of the sand together, and prevents its being dispersed by the wind, or burnt up by the sun. It enables it to hold more moisture, and thereby gives a stronger support and a richer nutriment to the roots of plants. A field well marled will retain its superior fertility for a number of years. Stiff clayey soils, on the other hand, are improved by the addition of *lime*, which loosens their texture, and corrects the coldness they acquire from imbibing too much water. No one kind of earth pure and unmixed is well fitted for the purposes of husbandry, and the best soils are composed of a mixture of all.

Most manures, however, are substances

stances possessing a fertilizing quality in themselves, and proper for almost any kind of soil. It is a very beautiful provision in nature, that matters the most noisome and offensive, and which we should most wish to remove out of the reach of our senses, are the most efficacious in bestowing fertility upon the earth. Putrid animals and vegetables, dung of all kinds, every thing oily and greasy, the sweepings of streets, foot, ashes, the scowerings of drains and ditches,—all, in short, that we call filth, refuse, and offal, if thrown on the land, is returned to us in the finest verdure, and the richest vegetable products. This is now so well understood, that a great part of the farmer's attention is employed in obtaining supplies of manure. He litters his yard thickly with straw and stubble, which, continually trampled by the animals he keeps, and receiving all that drops from them, becomes an
article

article of great value. This he heaps together ; and when sufficiently mellowed he carries it out to his land, spreading it over the surface, or plowing it in so as to mix it thoroughly with the soil. Whenever he sends his produce to the next town, his team brings back stable dung, the refuse of manufactures, and impurities of every kind, which would infect the air if not removed, but by this use of them are converted into a source of mutual profit. Populous places, which formerly paid a considerable annual sum to scavengers for keeping them clean, now receive a revenue from the sale of their filth. Thus nothing is lost ; but things the vilest in nature are made to contribute to the general good. In situations more remote from towns, ingenuity has discovered various other articles of manure. On the sea-coast, heaps of fishes thrown up by the tide are sometimes converted to this use.

Sea-

Sea-weed, and even the mud of the shore, impregnated with salt-water, prove valuable manures. Salt itself, though formerly made the very emblem of barrenness, is found, in a due proportion, to operate powerfully in forcing the growth of vegetables; and not only sea-salt, but every thing of a saline nature, has this property. Thus, the ashes of burnt vegetables, which yield the salt called fixed alkali, are employed as a manure; and it is a common practice to pare off the turf of barren soils, and, piling it in small heaps, to set them on fire, after which the ashes are spread over the land. In countries where many sheep are kept, arable land is much improved by folding these animals by night successively over it, when it becomes enriched by the oily droppings from their fleeces, and what else they leave behind.

It is to manure that gardeners are particularly indebted for the abundance

dance and luxuriance of their products. The rich garden-mould, indeed, is almost entirely composed of rotted vegetables, the relics of long cultivation. By the constant application of manure, the gardens in the neighbourhood of London are enabled to yield that prodigious supply of vegetables which such a city requires: for no sooner is one crop gathered, than the ground is prepared for the reception of another; and thus every season of the year, scarcely excepting the dead time of winter, has its peculiar harvests. Plenty of manure gives to the grass-fields round London that verdure, so grateful to the eye, which neither the burning suns of July, nor the pinching frosts of January, can destroy. But in no country of the globe is manure collected with so much care, and applied with so much effect, as in Japan, where the immense population has turned the attention

tion of the inhabitants to the utmost production of human food. By its means the whole country is cultivated as a garden, and is covered with a perpetual succession of crops of grain and other eatable vegetables.

But this letter is long enough. Farewell till the next !

LETTER V.

ON AGRICULTURE.

My dear Boy,

BEFORE I say more on the operations of husbandry, it may be proper to remark, that in the hot countries water is considered as the most valuable of all manures, and a great share of the skill of the husbandman is employed in procuring a due supply of it. Plants, it is found, will grow luxuriantly in water alone, if aided by a suitable degree of warmth; and in almost every climate, rank vegetation accompanies the course of brooks and rivers, and the moisture of marshes. You have probably read of the fertility bestowed upon Egypt by the annual inundation of its great river, the Nile, which

which stands it in the stead of manure, and even of the rain from heaven. That country, in reality, is only a long narrow slip of cultivated land on the banks of the Nile, bounded on each side by sandy deserts. The Ganges, and various other rivers which take their rise from high mountains, are subject to the same periodical floods at the melting of the snow, of which the inhabitants make their advantage, by drawing off the water through trenches and canals to the distant grounds. Many are the contrivances in Persia, China, and other thirsty countries of the East, for throwing up water from the channels of rivers and ponds, to the higher lands. Without these, the heat of the sun would soon wither every green thing, and the country would be rendered a barren waste. In our part of the world, the frequency of rains throughout the year causes these cares to be for the most

most part unnecessary ; yet the practice of occasionally flooding grass fields has been adopted with great success in several places, and as rich a vegetation has been obtained by it as could have been produced by any manure.

A preparatory operation to the culture of land, which is now seldom necessary in this country, is the clearing it of wood. This is the first business in forming settlements in the wilds of America ; and so stubborn a piece of work it is, that to a resident in that part of the world, the idea of a *cleared* country is almost the same with that of a cultivated one. It is generally reckoned too great a labour at first to dig up the trees by the roots ; but after the underwood is cleared away, the great trees are stript of their branches, and then *girdled*, as they call it, which consists in cutting a circle of bark round the trunk, whereby it is made gradually to decay. This, however,

is but a slovenly method, and only excusable for want of hands.

We will now suppose the ground fully prepared for receiving whatever the husbandman chooses to entrust to its bosom. A variety of objects present themselves to his choice, of which I shall only notice the principal. The vegetables selected for cultivation may be classed under the heads of “ 1st, food for man ; 2dly, food for animals ; 3dly, materials for clothing and other economical purposes.” I have already spoken generally of the articles of man’s vegetable food, and shall now say something of their culture.

Of the four kinds of grain cultivated in this country, two, namely wheat and rye, are called *winter-corn*, because they are usually sown in the autumn, and stand through the winter. The other two, barley and oats, are called *spring corn*, not being sown till that season. The cause of this difference

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ence is, that the two first strike deeper roots, and require a longer time to bring to maturity than the last. Of these grains *wheat* is by much the most valuable, and is peculiarly the food of man, for whose use it is reserved. It yields the purest meal, the greatest quantity of starch, and makes the whitest and most palatable bread. It requires, however, a better soil and climate than the others; and there are many parts of this island, particularly the mountainous and the more northern, where it cannot be grown to advantage. The soil best suited to it is a strong loam, or one which by a large proportion of clay is rendered of a fat and tenacious quality. As it greatly exhausts the fertility of the earth, it is reckoned bad husbandry to sow it two years together on the same spot, except in some remarkably rich soils, or with abundance of manure. Several kinds of wheat are cultivated,

tivated, differing in colour, size, and fineness of the grain, and suited to different soils. The red wheat, which is the most common, gives to our fields that peculiar richness of hue which prevails about harvest. Wheat is the farmer's pride: the wheat-sheaf is the emblem of plenty; and the wheaten garland was the antient decoration of Ceres.

Rye, though considerably resembling wheat, is a much inferior grain. Little of it, comparatively, is grown in this island; but in some countries it is the principal bread-corn of the poor, though the bread made from it is black and clammy. It suits northern climates, as it has the advantage of becoming ripe early. It is the tallest kind of corn, and therefore affords a great deal of straw.

Barley is next to wheat in point of value, and formerly used to make a great part of the sustenance of the poor.

Still,

Still, especially in times of scarcity, it is employed, either alone, or mixed with wheat, for the coarser kinds of bread. But the chief use of this grain in England is for the making of malt-liquors. I have already told you that malt is barley brought to a beginning state of germination. The immense quantity of these liquors consumed among us under the names of beer, ale, and porter, as well as the vast distilleries of gin or malt-spirits, render barley a very important article of cultivation. Much of it is also used in the fattening of oxen, hogs, and poultry. Barley will grow upon lighter and poorer soils than wheat, and is more commonly produced upon high grounds. Its quality, however, is much improved by warmth and manure. It is a grain of some of the warmest climates, and is the principal food of horses in Arabia, Persia, and the other countries of the East. Its

silvery hue when ripe, and the glossy softness of its beards, give great beauty to a field of barley waving in the wind. A particular kind of it, called *bear* or *bigg*, is grown in Scotland, and much used in making the spirituous liquor called whiskey.

Oats are a still inferior grain, and may be considered as the corn of cold and wet countries. The northern part of England and all Scotland used to be fed almost entirely with oatmeal; and still, in many parts, it is the great support of the lower classes. The chief use of oats in England, however, is for the food of horses; and so much is the number of those animals increased, that it is necessary to import great quantities of this grain from abroad, in addition to the home growth. Oats will grow upon wet and moorish soils where other corn would fail. The finest in this island are produced in the fenny country of Cambridgeshire and Lincolnshire.

Corn

Corn is the great object of culture to the farmer on arable land; and his skill is principally shown in suiting the kinds of grain to his various soils, and in establishing a proper rotation or round of crops, so that none of his land may become exhausted by the continued bearing of the same kind. The old practice of letting land lie fallow in order to recover itself, is now in great measure set aside by good farmers, and in enclosed fields; instead of which *green crops*, such as turnips, clover, tares, vetches, and the like, are interposed between the crops of grain. By their means the ground never lies a whole year idle, but is always employed for the support either of man or beast. I shall say more of these articles when I have done with those products which make part of the food of man.

The *leguminous vegetables* are less used for that purpose in this country

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than in many others. Beans, peas, and kidney-beans, when grown for the table, are generally cultivated in gardens, and are used while green. We cultivate, indeed, large quantities of field-beans, but they are commonly eaten by horses and hogs. They grow best in strong soils, such as are suitable for wheat. They are sown in the spring, and do not ripen till the very end of harvest. The grateful odour of a bean-field is well known to all who take country walks at the season of their blossoming. They scent the air for miles together in those districts where they are principally grown. On the other hand, the blackness of the pods and stalks when they are ripe is very unpleasant to the eye. But the farmer, who finds them a very profitable crop, does not concern himself with such trifles.

Field-peas are also sown in the spring. They are earlier ripe than
beans,

beans, and thrive on lighter soils. The sort called white peas form an article of human food, especially of sailors, who eat them boiled with their salt pork. The gray peas are principally the food of hogs.

Potatoes are now cultivated in the large way in most parts of this island, and take their turn with other crops. They are reckoned to be of the best quality on light sandy soils; they will, however, thrive in almost any soil deep enough for their roots, and sufficiently manured. There is no way in which ground can be employed in these climates so profitably to the production of human food, as in the culture of potatoes. The quantity of a good crop is prodigious, many times exceeding the weight of any crop of grain on the same space. By perfecting their growth under ground they are little exposed to injury from the weather;—a peculiar advantage in a

wet climate. Potatoes are used for the food of other animals, as well as man; but they do not answer well without previous boiling.

But I have now, I believe, given you as much provision as you can digest at once: so farewell!

LETTER VI.

AGRICULTURE CONTINUED.

LET us now see, my dear boy, what man has done more particularly for the sustenance of those animals which he has made, as it were, part of his household. It cannot be pretended that he has the merit of disinterested kindness in this matter; yet things are so ordered, that, by consulting his own good, he in reality promotes that of the creatures which he has taken under his dominion. They are in general better fed, better defended from the inclemencies of the weather and from their enemies, in his keeping, than in a state of nature; and when the quantity of labour which he bestows upon them is considered, he

may be reckoned fairly to have purchased the advantages which he derives from them.

Of the leguminous plants cultivated solely for the use of cattle, are clover or trefoil of various kinds, vetches or tares, sainfoin, lucerne, and some others. *Clover* is frequently sown along with corn, so that, when the corn is cut, a field covered with this plant remains. It is a rich nutriment for all domestic animals ; and they are so fond of it, that, when suffered to eat it green in the field at their pleasure, they are liable to burst from the quantity they devour, which ferments and swells in their stomachs. So you see that it is not men alone who are subject to indulge their appetites to a hurtful excess; and that *living in clover* is a dangerous condition to all creatures. Clover hay is a strong food for working cattle. Two crops of it are generally mown in the year, and it is

a valuable article in the farmer's stock. Vetches are often mown early in the year for green fodder, and the land is then laid down for some other crop. Lucerne will give several successive green crops in the season. Sainfoin is reckoned particularly suitable to thin chalky soils, and it is dried for hay.

The *turnip* forms a very important article in the improved system of husbandry. This plant, you know, produces a root of remarkable size and roundness, consisting of a very white firm substance, of a sweetish taste. When cultivated in gardens it is one of our table vegetables, and I dare say you are acquainted with its merit as a companion to boiled beef and mutton. The field turnips are of the same kind, but are grown as food for cattle. They thrive best in a light soil; and instead of impoverishing the ground, they excellently prepare it for crops of grain.

By their means some of the poorest sandy soils have been brought into culture, and made to yield valuable crops of barley and oats. They are frequently sown as soon as ever the corn is carried off the land, with the intention of using them as the winter and spring food of cattle when all other forage is scarce; and thus the farmer is enabled to maintain a much larger flock of animals than he could otherwise do. Turnip-fields greatly enliven a country to the eye by their vivid green, at a time when the land in general wears the sad hue of the declining year; but they are not equally agreeable to the other senses, since they have a rankness of flavour which infects the air, and which may be perceived in the milk and flesh of the animals fed upon them. In this case, as in many others, the necessities of a large community cause quality to be sacrificed to quantity. These roots
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are either eaten upon the spot where they grow, or pulled up and given in the fold or yard. Sheep and oxen both feed readily upon them, and acquire great dexterity in scooping out the heart and leaving the rind.

Other vegetables which have got from the garden to the field as the food of animals, are cabbages, coleworts, carrots, and parsnips. All these in certain soils answer well, and make an useful variety of cultivation.

But the principal article on which domestic animals are nourished is *grass*; that which constitutes the verdant carpet spread spontaneously by nature's hand over the surface of the earth. Of grasses there are almost numberless species, which grow intermixed, and are adapted to all soils, from the marsh to the mountain. Farmers in general do not trouble themselves to select particular kinds of grass for their meadows and pastures, but trust to nature

nature to cover them with the sorts proper to the soil and situation. Yet when land is changed from arable to pasture, and the seeds of grafs are designedly sown upon it, care should be taken to choose the best sorts, as free as possible from weeds. A species called ray-grass is a favourite in some places, on account of the height to which it grows early in the year; but it is hard and coarse. It is not uncommon to mix a proportion of white clover seed with those of grafs, by which the ground becomes well covered at the surface.

Grass is either eaten on the place, which is called *pasturage*, or it is left untouched to the time of its full growth, and then mown, dried in the field, and made into *hay*. Though grafs in drying loses great part of its juices, yet it retains its nourishing properties, and is improved in its fragrance. The smell of new hay, you know,

know, is one of the most grateful odours; and when well preserved, it retains its sweetness a long time. The process of hay-making consists in the thorough drying of the grass when cut, and it should be performed with as much expedition as possible. For this purpose it is spread abroad to the action of the sun and wind, frequently turned over, and formed into little heaps or cocks to protect it from showers and the night dew. As the season in which hay is made, the middle of summer, is subject to violent rains, it is an anxious time for the farmer, who often sees his crop completely wetted when just fit to carry, and has all the business of spreading, turning, &c. to go over again, to the great addition of expense, and injury of the product. Negligence and delay are sure of their punishment in this than in most country work; and “making hay while the sun shines”
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has long been a proverbial precept. If, however, the hay is carried in too much haste, before it is sufficiently dry, it is apt to heat so much in the ricks as to take fire; and there are few years in which such accidents do not happen. In some parts of England, especially in the well-manured fields of Middlesex, two crops of hay are got in the year; but, more commonly, farmers are content with a single crop, and the field is employed for the remainder of the year as pasture.

As for the fields which are constantly pastured, the only attention paid to them is to remove the cattle from one to another as the grass is eaten down, and give it time to shoot up again. Low rich grounds by the side of streams, especially where subject to occasional floods, can scarcely be more profitably employed than by being left in grass. The expense of culture

culture is small, and the product, whether hay or green fodder, is valuable. All the dairy farming for the production of cheese and butter depends chiefly upon grafs; for none of the artificial foods for cattle yield milk so sweet and pure as the natural grasses. The short grafs of mountains and high downs is the favourite pasture of sheep, who thrive upon it better than upon richer herbage. Large tracts in this island are left in a state of nature to serve as *sheep-walks*, which is probably the best use to which they can be applied.

What nature has done by means of grafs for the sustenance of animals, is seen to perfection in the vast meadows, or savannahs, as they are called, which border the great rivers in the southern parts of America. These are covered with prodigious herds of wild oxen, the parents of which escaped from the colonists who first settled in the country,

try, and multiplied in these luxuriant pastures, where the warmth and moisture of the climate afford a perpetual growth of herbage, both summer and winter. Along with them are numbers of buffaloes, and of deer of various species, the original inhabitants of the country. Here the grass grows to such a length as almost to conceal the tall animals which feed in it, and it is frequently fired by the hunters to force them from their retreats. A remarkable instance of the quick increase of the grazing animals in unstinted pasturage was lately produced from the settlement of New South Wales. A party sent to explore the interior parts of the country, discovered in a green sequestered valley a herd of near a hundred cows and calves feeding, protected by a large and very ferocious bull. As no animals of this species are natives of that part of the world, they must have been the progeny of a pair
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of horned cattle belonging to the settlers, which had rambled away a very few years before.

I think I may now close my account of such articles of food for man and animals as in our island are objects of agriculture. I might, indeed, take notice of some products used in *drink*; as apples and pears, which afford cyder and perry, the common beverage in some counties; and hops, an ingredient in malt liquor, largely cultivated in various parts of the kingdom: but it does not come within my plan to enter into these particulars. For the same reason, I shall forbear to enumerate the products of the garden, and the several methods of culture practised in it, both of which are so extremely various, that large books have been written of them alone. It is enough in general to observe, that the additions made to our diet by the art of gardening have tended to render
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it both more pleasant and salubrious. The garden vegetables, whether eaten raw, as fallads, or boiled, as greens and roots, are the best correctors of strong and salt animal food, and effectually prevent that dreadful disease, the scurvy, which proves so destructive to seamen, and to those on shore who live on the same kind of provision. In reading accounts of long voyages you will be struck with the eager longings for fresh vegetables of any kind shown by the poor sailors. For their use, gardens are cultivated at all places where they touch in their course; and navigators have been attentive to sow garden-seeds plentifully on all the uninhabited shores and islands they have visited, that those whom chance should afterwards bring to the same spots might find necessary refreshments.

A garden is an appendage of civilized life: it decorates the palace and
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cheers the cottage. A very small piece of ground cultivated as a garden will afford essential support to a poor family; and it is to be wished that no labourer's house in the country were unprovided with this benefit. By the help of cabbages, onions, kidney-beans, lettuces, and the like, many a scanty meal might be improved; and the employment of a few leisure hours or holidays would be sufficient to add materially to the comfort of the year.

But it is time to conclude my letter. Adieu!

LETTER VII.

ON ANIMAL FOOD, AND THE MEANS
OF PROCURING IT.

My dear Boy,

HAVING thus long kept you, like an antient Pythagorean or modern Bramin, solely upon vegetable food, I now proceed to mend your diet by adding to it that large supply of human sustenance which is derived from the animal creation. As I am convinced that man has as good a right to kill beasts for his food, as they have to kill one another, I shall not attempt to spoil your appetite by interesting your compassion in favour of the victims, or dwelling upon the cruelty of a butcher's shop. You may find some very pretty lines to the purpose

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pose in the poet Thomson, who, however, could eat his beef-steak with as good a relish as any man. Treat animals kindly while they live, and never take away their lives wantonly; but you need not scruple to make that use of their bodies which nature has plainly ordained.

Although I have supposed that the earliest food of man was of the vegetable kind, yet there are several situations in which we can conceive him placed, that would rather prompt him to seek his first sustenance from the animal tribes; and even at this day, in various parts of the globe, he is only a hunter or a fisher. In the midst of vast forests abounding with game, but scantily provided with eatable vegetables, men have become a kind of beasts of prey, and their appetites have been entirely carnivorous. On the inhospitable shores of the frigid regions, where the rigours of the climate deny
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any other product of the earth than a little coarse grass, and a few stunted herbs, the human native through necessity looks to the fertility of the sea to compensate the barrenness of the land, or climbs the naked rocks to collect the eggs and young deposited there by those fowls which are fishers like himself.

There is scarcely any quadruped, bird, or fish, upon which man cannot occasionally feed ; but he usually prefers those whose flesh is tender, and free from any peculiar rankness of flavour. The parts in which the principal nourishment consists are the muscular flesh, and the fat. The former is rendered nourishing by the glutinous or jelly-like matter it contains ; the latter, by its oil. Other parts, however, even the bones themselves, may be made to yield the same substances by boiling.

It would be an endless task to describe

scribe all the modes which the ingenuity of man has invented for catching wild animals, nor could I, by words alone, make many of them intelligible: we will, however, take a general view of the principal. Being less swift than the greater part of the objects of his pursuit, he has been obliged to have recourse either to missile weapons, by which he might arrest them in their flight, or to traps and snares to detain them. No savages have been discovered so void of art, as not to have adopted contrivances of both these kinds. The missile weapons have generally been the bow and arrow, the dart, and the sling. With all these I suppose you are acquainted, and probably you have yourself been a manufacturer of bows and arrows. Armed with these, the hunter places himself in ambush, and strikes at the passing game: or he steals upon them unawares as they feed, crawling on the

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ground,

ground, or concealing his approach behind the stuffed skin of some harmless animal, which figure is usually called a stalking-horse. The range of these weapons, however, is trifling, compared with that of fire-arms, which have taken place of them wherever they could be procured. By their means the bird is brought down from the summit of the loftiest tree, or is even stopped in his rapid flight; nor does the fleet antelope or bounding chamois escape the ball of the sportsman from his distant station. The deadly force and sure aim of these arms have even emboldened the hunter to attack in the open plain the huge elephant and the formidable rhinoceros.

But greater numbers of wild animals, and of shyer natures, are caught by the contrivances of snares. In constructing these, extraordinary ingenuity has been displayed by some of the most untutored nations; thereby showing

showing what the human faculties are capable of when earnestly applied to any one object. By their means, the terrible lion is made a captive to man, as well as the crafty fox or timid hare. Birds are frequently taken in nets, in which they are entangled by various artifices: some of their own species are often trained to assist in the fraud, and they seem to take a malicious pleasure in decoying their companions to the snares into which themselves have fallen. Fishes, inhabiting an element in which they cannot be followed, are caught either by the allurements of baited hooks, or by nets spread to intercept their course. Some of the larger species are struck while swimming, with a dart or harpoon skilfully lanced from a boat.

The voyager, Dampier, has given a very curious account of a tribe of men whose art in taking their animal prey is truly extraordinary. They are

called the Moskito Indians, and are natives of part of that neck of land which separates North from South America. These people are brought up from their infancy to throw the lance or harpoon with great exactness, in order to fit them for their principal employment, which is that of striking fish, sea-tortoises, and manati. For their dexterity they are much valued by the crews of ships frequenting those parts, who give them great encouragement to come on board; and it is said that a couple of them in a ship will provide subsistence for a hundred men. They bring with them their little canoes, in which they regularly dispose all their tackle, and they will not suffer any other person to get into them. Indeed, any European sailor would be in danger of immediately upsetting them. With these they put out just at their pleasure, for they will bear no control; and they seldom fail of success.

cess. "I have known (says Dampier) two Moskito men every day for a week bring aboard two manatees, the least of which has not weighed less than 600lbs." They are also equally dexterous in killing game in the woods, so that they are well able to subsist themselves in any situation. The same writer gives an entertaining relation of a Moskito Indian, who being left accidentally on the island of Juan Fernandez, lived there alone for three years, till he was brought away by the ship to which Dampier belonged. He was left with a gun and a knife, a small horn of powder and a few shot; which being spent, he contrived a way, by notching his knife, to saw the barrel of his gun into small pieces; where-with he made harpoons, lances, hooks, and a long knife. These he forged, by heating in a fire, and then hammering out and bending by means of stones; after which, he gave them a

proper temper, and ground them to an edge by long labour. By the help of these instruments he procured such provisions as the island afforded, either goats or fish; and was in perfect health and vigour at the time they found him.

These *arts of life*, however, when they form the employment of a whole people, denote a state of society little advanced in civilization. The hunter-tribes, spread over a vast tract of country, and living much in solitude, have small opportunity of improvement from mutual intercourse. They resemble the animals which live upon the same prey with themselves; and when not engaged in the chase, they either make war upon each other, or spend their time in absolute indolence. Their supply of food, likewise, is always precarious; sometimes abundant beyond their wants, at other times so scanty as to reduce them to the extremities of famine.

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A great advance from this condition of mankind is the *shepherd- or pastoral-state*. Certain animals seem formed by nature to be domesticated by man, and live under his protection, which they repay by a regular supply of his necessities. From the earliest times we read of tribes which have wandered over extensive regions, driving their flocks and herds from pasture to pasture, fed by their milk and flesh, and clothed with their hides and fleeces. This was the life led by the antient patriarch in the plains of Mesopotamia, by the Scythians, Arabs, and Numidians; and at this day it is exactly followed by the Bedoweens of Asia and Africa, and the numerous hordes of Tartars. The animals selected for domestication have been the sheep, the goat, the ox or beeve kind, the camel, and the reindeer. The Tartars join the horse to their other pastoral wealth, and not only as a beast of burden, but as af-

fording a choice aliment from its milk and blood. Such a kind of life will not admit of fixed dwellings. The shepherd people have therefore always inhabited tents, or huts placed upon wheels, with which they have constructed moveable towns or villages, wherever the change of pasturage led them. By living together they have acquired more civilization than the hunters, though less than the cultivators of the land.

These pastoral nations are now, however, few and inconsiderable, and the rearing of domestic animals is a part of the regular business of farmers in every country, their flesh and other products being in general use. In our island the quadrupeds bred for food are chiefly the ox, the sheep, and the hog. Goats are kept in flocks only in some of the mountainous parts of Wales and Scotland. Deer are confined to gentlemen's parks, and considered

sidered only as objects of luxury. Rabbits in a warren can hardly be said to be under the dominion of man, though first placed there and occasionally fed by him.

One of the articles of food yielded by the domestic animals deserves particular notice, as it has long been an object of rustic art. This is *milk*, a liquor prepared by nature in the females of all the warm-blooded quadrupeds for the sustenance of their young; but which man, who applies to his own use every thing that he finds suitable to his occasions, has converted into an aliment for himself. It is of a middle quality between animal and vegetable; and indeed partakes so much of the latter, that the gentle tribes which reject all animal food do not scruple the use of milk. It is the milk of the herbivorous animals alone which enters into human diet; and the cow, as the largest and

most productive of the kind, is the species commonly preferred for the dairy. In many countries, indeed, and in the northern parts of this island, sheep and goats also are milked; and the milk of the afs is used as a medicinal article of nourishment; but cow's milk is the staple upon which this kind of food depends. Milk is so quickly and copiously separated from the fluids of the animal, that it retains many of the properties of the vegetables on which it feeds. What a delicious draught is milk fresh from a cow just returned from a pasture abounding in fine grafs and wild flowers! To an unvitiated palate none of the artificial products of fermentation are comparable to it.

Milk is good either as nature yields it, or boiled and mixed with bread and other farinaceous substances. After standing awhile, it throws up a thick scum called *cream*, which, by brisk agitation,

agitation, is mostly converted into the solid oil so much used in our diet under the name of *butter*. The instrument by which this is made is a churn, and a proper degree of heat assists the process. Fresh butter is one of the most grateful of oily or unctuous substances; and, when not used in too great quantity, is a wholesome article of food. Milk contains also a mucilaginous part, which separates after the coagulation or curdling of the fluid. It forms a white solid matter called curd, which, pressed and salted, becomes *cheese*, the other most important preparation from milk. It is a strong and hearty diet for working people, and a delicacy at the tables of the rich. There is a great variety in cheeses as to taste and other qualities, and the manufacture of them is one of the principal arts of the rural housewife. Many pasturing districts are almost entirely devoted to its production,

tion, for the demand for it is very considerable. The *whey* or watery part which constitutes the chief bulk of the milk, holds a proportion of sugary matter dissolved in it, and soon turns sour. When fresh, it is a pleasant cooling drink; but most of it falls to the share of the hogs. I omitted to mention that the curdling of milk is promoted by adding a little of a liquor called rennet, which is made by steeping a piece of the inside skin of a calf's stomach in warm water. Dairy-women keep by them these skins salted and dried for use.

The flesh of the domestic animals commonly employed for food in this part of the world, is that of the ox and the sheep, called beef and mutton; of the same animals while young, called veal and lamb; and of the hog, called pork. Goats' flesh, from its rankness, is seldom eaten but from necessity, but that of the kid is nearly
as

as good as lamb. The above go under the name of butchers' meat, and are in constant use at the tables of those who can afford it. They are all wholesome when joined with a due proportion of vegetables. Where it is requisite to keep them long, as in sea voyages, salt is applied in large quantity ; but the meat is thereby rendered less salubrious and nourishing. Beef and pork take salt the best, and may be preserved the longest.

Besides these quadrupeds, some birds have been rendered domestic, and agreeably vary man's animal food. Those selected for this purpose are the poultry kind, of which are the common cock, the turkey, peacock, and guinea-fowl : pigeons, both the wild and tame : and some of the aquatics, as ducks and geese. These are reared at little cost by the farmer, in whose yard and fields they pick up what would otherwise be lost ;
and

and their delicacy renders them a valuable object of profit.

Fishes may be said in some measure to be domesticated by the practice of storing ponds with them, whence they may be taken at pleasure. But in this way they are regarded only as articles of luxury, like the venison of the park, and the game of the cover. Fish, as an article of common food, is taken from the sea or rivers, and sometimes so abundantly as to form the principal subsistence of the neighbouring inhabitants. But its supplies are uncertain, depending much upon weather and season; nor is it so nourishing as flesh.

But I fear I have tired you with the length of my letter; so farewell!

LETTER VIII.

ON THE PREPARATION OF FOOD.

HAVING now laid before you a very abundant supply of provision, it is time to consider how it is to be used. This is a care which does not concern other animals, who take their food in the state in which nature has presented it to them; but man has scarcely ever been found so savage, as not to have employed some mode of preparing the articles of his food, so as to render them more wholesome and agreeable than in their raw state. Hence the *art of cookery* may be reckoned among the arts of life; for though it has been abused to the purposes of voluptuousness, yet in its principles it is founded on just considerations of health and economy.

economy. If it be requisite to ennoble cookery, it may be regarded as belonging to physic in its intention, and to chemistry in its practice: I do not mean, however, to enter further into its mysteries, than to give you a notion of some of its simplest operations. The kitchen, you know, is a kind of prohibited place to our sex; and I do not wish you to incur the opprobrious title of a *cot*. Men, when alone, have, indeed, a right to be practitioners in this art, and sailors are often found to be very able cooks. But we will first visit a place where a previous preparation is going on.

I have already mentioned that most of the farinaceous seeds are reduced to powder before they are used as human food. In this process they are at the same time deprived of their husk or outer coat; which, indeed, it is necessary to do even when their kernels are left entire. Savage nations have been
contented

contented with pounding or bruising their corn between stones; but civilized people, from the earliest records of society, have had the practice of grinding it in *mills*. This operation is performed by means of two round flat stones, of a hard quality, the upper of which turns upon the other, which is fixed. They are set at such a distance as just to admit between them the grains of corn, which are poured through a hole from above. These are partly crushed, partly cut by the edges of scores made in the mill-stones, and at length brought to a meal, more or less fine according to the space left between the stones. The whirling motion at the same time throws the meal to the outer part of the stones, where it is received in a circular box, and carried downwards through a trough. It then passes through sieves of different fineness, which separate the bran and the other
skinny

skinny parts from the pure flour. The degree in which this separation is effected makes the difference in flour as to whiteness and fineness. Antiently corn-mills were worked by the strength of men, and this business constituted one of the most laborious of domestic employments. But this labour is now saved in civilized countries by the invention of wind and water mills, in which the motion is imparted either by the force of the wind acting upon sails, or by a current of water pushing against boards which are fastened to a wheel. Many of these, especially the water-mills, are very curious machines, of great power and complicated contrivance, in which the operations of drawing up the sacks of corn, emptying them, grinding, sifting, and the rest, are performed with wonderful ease and regularity, without any help of men's hands.

As to the preparation which the articles

ticles of food undergo in picking, paring, cleansing, and separating the useful parts from the refuse, it is too obvious to require any particular mention; so we now proceed to the art of cookery itself.

All cookery depends upon the application of heat, either dry, or through the medium of water or steam. It is an universal effect of heat to expand the substance to which it is applied, and thereby render it more easy to be dissolved or broken down. Such, indeed, is the power of heat, that scarcely any substance can sustain a high degree of it, without that separation of its parts which destroys its form, and which chemists term decomposition. It is evident, therefore, that heat must prepare food for being digested in the stomach. It likewise heightens the taste of various things, corrects their rawness, and makes them more agreeable to the palate. In some instances

instances it dissipates noxious parts, and converts a natural poison into wholesome nutriment. Of the methods of applying heat, the simplest is exposing the substance to a naked fire; and this must be the only one practised by those nations which have not discovered any material that can hold water, and at the same time bear the fire. Thus, the natives of the South-sea islands, when first visited by our navigators, had not the least notion of boiling water, and were much surprised at being scalded by putting their hands into a kettle.

The effect of dry heat is, I dare say, familiar to you in the school-boy cookery of roasting an apple or a potatoe. You would perceive that in both these cases it softens and breaks down the firm pulp of the substance, causes it to shrink in bulk by expelling part of its moisture, improves the taste, and in the potatoe corrects that earthy
flavour

flavour which is disagreeable in the raw root. Toasting, baking, and roasting are different processes of this kind. In baking, the heat is confined in a close place, and applied equally and regularly. I shall speak particularly of the principal article cooked in this way, which is *bread*.

The simplest manner of preparing meal or flour for eating, is by making it into cakes with water alone. Wheat-en flour is thus made into ship-biscuit, which is rendered so hard and dry by baking, that it will keep sound for a great length of time. Oat-cakes are made in the same manner, and are usually baked over the fire upon a flat stone or iron plate. But, from the earliest times, civilized nations have had the practice of converting corn into what is properly named *bread*. This is done by mixing the flour with a *ferment* or *leaven*, and working it up into a proper quantity of water (generally with

with the addition of salt) into a soft paste, or dough, which, when set in a warm place, acquires an intestine motion, and heaves or rises. It is then made into loaves, and put into the oven. By baking, the loaves become covered with a firm crust, including a soft spongy crumb. The superiority of bread over biscuit or unleavened cakes consists in its being more tasteful, more easily chewed, and lighter to the stomach. The ferment employed is, in this country, almost universally, that scum which arises to the top of malt liquors while fermenting, and is called *barm* or *yeast*. In most other countries it is a piece of the dough itself, suffered to grow sour; and this is what particularly bears the name of *leaven*. It is very material to the making of good light bread, that the ferment should be thoroughly mixed with the dough, and the whole mass well *kneaded*, by which means
“ a little

“ a little leaven leaveneth the whole lump.”

Having thus instructed you in the important art of bread-making, I shall not descend to the consideration of puddings, pies and pastry, the invention of luxury, but proceed to other matters of plain cooking.

The application of dry heat was, doubtless, the original cookery of animal food ; and Homer's heroes are represented as very expert at cutting up a sheep or a porker, and broiling steaks upon the coals. With the cleanly intervention of a gridiron, this is still one of the most favourite kinds of cookery ; and few delicacies are so grateful to a true English palate as a tender beef-steak done *secundum artem* at a chop-house. Frying in a pan is in some respects an improvement on this process, as it protects the meat from the smoke and flame, and preserves the fat. But since neither of these

these methods would succeed with a whole animal or a large joint, it was a bright invention to run a spit through the subject, and turn it round and round before the fire. This contrivance, from the gradual and equal application of the heat, has somewhat of the effect of baking; and being practised in the open air, it avoids a kind of disagreeable taint which meat is apt to get in the oven. Various devices have been adopted to make the spit go, without stationing a poor boy where he is half-roasted himself in turning it. The jack has obtained the final preference, set in motion either by means of a weight which turns an axle as it descends, or by flyers placed in the chimney, and turned round by the air rushing upwards, which last is usually called a smoke-jack. Roasting is much practised in England, where we love to bring large joints to table; but it wastes much of the juices of the
meat,

meat, and consumes a great deal of fuel. All the applications of dry heat make animal food more savoury by imparting a degree of burnt flavour (called by chemists *empyreuma*) to its oils, and exalting or rendering more pungent its salts. At the same time it is made more stimulating, and less fit for delicate constitutions and weak stomachs.

The use of water in cookery is very extensive. The roots and green parts of vegetables are commonly boiled, whereby their substance is made tender, and the crude unpleasant taste of many of them is corrected. Several kinds of vegetables, such as the whole cabbage tribe, would not be eatable without boiling. I have known boys make themselves seriously ill by eating raw turnips and carrots, which lay undigested on their stomachs, whereas by boiling they become perfectly wholesome. Water poured boiling

hot upon certain herbs extracts their taste and flavour, and thus affords an article either of food or medicine. These liquors are called infusions or teas. The latter name is borrowed from the real *tea*, a shrub growing in China, the leaves of which are brought over in prodigious quantities and at a vast expense, to furnish us with a beverage, which by habit is now become almost a necessary of life. Yet it affords no nutriment of itself, but only serves to give water an agreeable flavour, with some other qualities which perhaps are more hurtful than useful. Such is the power of custom! The berries of the coffee shrub are employed in a similar manner in most countries in Europe, and more particularly in Turkey and other parts of the East.

Animal flesh boiled in water becomes thoroughly penetrated with the heat, without any of the effects of burning.

burning. It is therefore milder than roasted or broiled meat, and is on that account fitter for weak and delicate persons. But the action of the water robs it of some of its nutritious juices, and, if long continued, renders it quite tasteless and void of nourishment. This property of water is the foundation of a very useful kind of cookery, that of making broths or soups, which contain all the nutritive part of animal substances, without the gross and useless parts. They have generally the addition of some of the aromatic or strong-flavoured herbs, and are often thickened with farinaceous matters. It is perhaps the highest exploit of cookery as an useful art to produce these agreeable and salubrious mixtures of animal and vegetable substances, in which every thing is employed to the greatest advantage in an economical view, and the palate and digestion are equally consulted.

The use of condiments or seasonings to food, though much abused to the purposes of luxury and intemperate gratification, has, however, a place in simple cookery. Salt is the principal of these articles; and few nations who have been acquainted with it have failed to employ it in some manner in their diet. The people of Otaheite were found to have the practice of setting by them a vessel of sea-water, into which they dipped each morsel before swallowing it. Even sheep and cattle show a great fondness for salt, and will lick lumps of it with great relish. A small proportion of salt is supposed to assist the dissolution of food in the stomach, besides giving a taste to things of themselves insipid. The warm aromatic vegetables, such as mustard, horse radish, pepper, and other spices, are useful in correcting the cold and windy nature of certain foods, and impart vigour to the stomach. It
seems

seems extraordinary that the natives of the hottest climates are most fond of spices, which they mix in such quantities with their food, as would absolutely fire the mouth and throat of one unaccustomed to them. This is owing to the relaxing power of heat, which renders the strongest stimulants necessary to rouse the languid organs to exertion. The Greenlander and Samoiede, on the other hand, think train oil the finest of all sauces to their dried fish or flesh, and are able to digest a full meal of whale's fat. Thus nature suits her gifts to the several necessities of her children! Farewell!

LETTER IX.

ON THE ARTS RELATIVE TO
CLOATHING.

My dear Boy,

I AM now to introduce you to another division of the arts of life, the necessity of which you will not question—those by which man provides himself with that covering for his body with which nature has neglected to furnish him. This necessity, indeed, is less universal than that for procuring food; since there are climates in which cloathing is scarcely requisite, except as far as the purposes of decency demand. Within the tropics, the black colour of the natives, and the natural oiliness of their skins, increased by the use of unguents and
paint,

paint, sufficiently protect them against the ordinary inclemencies of the weather. Yet even in those countries, the practice of going entirely naked is a sign of a state little advanced beyond the savage; and some kind of apparel is usually worn, at least by the superior classes. In all the cold and temperate parts of the globe, the want of cloathing begins at the instant of birth, and is one of the most urgent.

The first covering to the body in warm climates may probably have been the large leaves of trees fastened together by the fibres of the same; but this must have been so slight and little durable, as soon to be set aside for better contrivances. To interweave the long and narrow leaves of plants of the grass or reed tribe in the form of a mat, would be a pretty obvious expedient; and to this day we find that some savage tribes have proceeded no further. Yet, simple as this

contrivance may seem, it is the origin of the art of weaving. A kind of cloathing still more simple probably occurred to the inhabitants of colder countries, namely, the skins of slain animals, those very coverings bestowed by nature upon them, and denied to man. The savage hunter who had killed a bear, at the same time made a display of his prowess and enjoyed the reward of it, by wrapping round him the shaggy spoils of his game. You have read, perhaps, of the lion's skin of the renowned Hercules, which, with his club, is all the furniture usually given by painters and sculptors to this antient hero. At this day, a sheep's skin, with the fleece outwards in summer, and inwards in winter, forms the principal garment of some northern people; and I have read of a very simple and compendious mode of cloathing a young Tartar, by throwing over his shoulders the
raw

raw hide of a horse, and shaping it to his body with a pair of sheers. Cloathing, as well as food, may therefore be divided into the vegetable and animal; and I shall follow this order in the account I am going to give you of the several materials of dress in use among more civilized nations.

The *vegetable* matters employed for this purpose are chiefly of two kinds; the fibres of the stalks and other parts of plants, and the downy substance in which the seeds are sometimes bedded. The fibrous or stringy texture is very prevalent in vegetables. We see it in the bark and wood of trees, in the stalks of green or herbaceous plants, and in the leaves of all. The longer parallel fibres are held together by shorter cross ones, forming a network, cemented by a glutinous matter. The ingenious though but half-civilized people of Otaheite have discovered a method of making tolerable cloth of

the inner bark of certain trees, steeped in water, then beaten with a wooden mallet, and reduced to a soft pliable texture, much resembling in appearance woven cloth, though the fibres are never entirely separated. But this manufacture has the defect of not bearing to be washed, and is besides of little durability. The more artful way of employing vegetable fibres consists in an entire separation of them from the matter that held them together, reducing them to clean loose bundles, then twisting them into threads, and lastly interweaving them. I shall describe these operations presently.

The plants selected in our part of the world for the purpose of making thread and cloth from their fibres, are chiefly flax and hemp.

Flax (in Latin, *linum*, whence the word *linen*) is an annual plant, rising on a single stalk to a moderate height,
and

and crowned with handsome blue flowers, succeeded by globular seed-vessels. It is cultivated more or less in most of the countries of Europe, and succeeds best in a strong loamy soil, with a good deal of moisture. It is suffered to grow till the seeds are ripe, and is then plucked up by the hand, laid in little bundles to dry, deprived of its seed-vessels, and then put into pits of water to rot. The purpose of this part of the process is to dissolve a gummy or mucilaginous matter which holds the fibres together. It is the most disagreeable thing belonging to the management of flax, since the smell arising from it while rotting is extremely offensive and prejudicial to the health, and the infected water is apt to kill the fish which swim in it. When the flax has lain long enough, it is taken out, washed, dried, then beaten with mallets, combed, and by various other operations

rations so prepared, that the long fibres are got by themselves, clean and loose, in which state they are shining, soft to the touch, yet strong. It is this which the manufacturers call *flax*: the shorter and coarser fibres separated by the comb are called *tow*. The staple of flax is longer or shorter, coarser or finer, according to the soil in which it is grown, and the methods used in dressing it. The operation of spinning, which it next undergoes, consists in drawing out with the fingers several of the fibres together, and twisting them. This was originally done by means of a distaff, or rock, on which the flax was fastened, and which was stuck in the girdle, while one hand of the spinner was occupied in drawing out and twisting the thread, and the other in winding it upon a reel or spindle. But this method has long given way to the use of a simple machine called a wheel, in which the
twisting

twisting and winding are performed by means of a wheel turned by a treadle. Spinning has been a part of the domestic occupation of women from the earliest ages; and notwithstanding the modern use of compound machinery, the spinning of flax is usually performed by them at home in the old way. The spinning-wheel is a pleasing object in cottage-scenery; and it is desirable that some employments should be reserved in a simple state, which may fill up the vacant hours of rural life, and offer some reward to humble industry. The product of spinning is thread, which is more or less fine according to the dexterity of the spinner, and the nature of the material. Some thread closer twisted than the rest is kept for needle-work; but the greater part is made up in bundles called linen-yarn, and committed to the weaver.

I know not how, by verbal description,
tion,

tion, to give you any clear ideas of that common engine, the loom; and you may learn more from five minutes observation in a weaver's shop, than all my pains in writing can teach you. A few words to give you a general notion of the art may, however, not be thrown away. I have already told you that weaving may be regarded as a finer kind of matting. To perform it, the threads which form the length of a piece of cloth are first disposed in order, and strained by weights to a proper tightness; and this is called the *warp*. These threads are divided, by an instrument called a reed, into two sets, each composed of every other thread; and while, by the working of a treadle, each set is thrown alternately up and down, the cross threads, called the *woof* or *weft*, are inserted between them, by means of a little instrument, sharp at both ends, called a shuttle, which is briskly shot from
one

one of the weaver's hands to the other, placed on the opposite sides of the work, and carries the thread with it. This is the simplest kind of weaving; but numberless are the additional contrivances made for all the curious works wrought in the loom, which have been the objects of human ingenuity for many ages.

The linen fabrics are of all degrees of fineness, from coarse sheeting, to cambric almost emulating a spider's web. They are brought to that extreme whiteness which we so much admire, by the process of bleaching. This consists in their exposure to the action of the sun and air, with frequent watering, and often with the help of some acid liquor, which quickens the operation, but is apt to injure the cloth if not applied with great caution. The value that can be given to a raw material by manufacturing is in few instances more strikingly

strikingly exemplified than in the conversion of flax into point or Brussels lace, some of which sells for several guineas a yard. Indeed, if you look at a plant of flax growing, and then at the frill of your shirt, you cannot fail to be struck with admiration of human skill and industry.

Linen is one of the comforts of civilized life. It is cooler and more cleanly than any other wearing material, as it is free from downiness, and presents a smooth surface. We therefore prefer linen for our under garment; but it would be too cold for our climate did we not cover it with others of a warmer texture. Linen, in Europe, is a luxury of the later ages; for though we read of the fine linens of Egypt in early times, it is certain that the polished Greeks and Romans did not commonly use garments of this material. Thus it has been remarked of Augustus, the master

ter of the Roman world, that he had not a shirt to his back. Linen, when worn to rags, has still a considerable value; for the finest writing and printing paper is made from it. But paper-making is an art which does not yet come within the scope of my letters.

Hemp is a much taller and stronger plant than flax. It has a square rough stalk, rising to the height of five or six feet, and sending off branches. It is an annual plant, produced from seed. The young ones come up, some male, some female; the former, furnished only with flowers producing a farina or dust; the latter, yielding the seed. Hemp thrives best in a rich moist soil, especially on the banks of rivers; and it prefers the temperate climates to the hot. When come to maturity, it is plucked up and laid to rot, like flax. Its fibrous part consists in the bark surrounding the main stalk, within which is a hard woody part, of no use.

use. It is therefore necessary either to strip off the bark, or, by hard beating, to convert the inner matter to a dust, which may fly away. Hemp undergoes the same general preparation as flax before it is consigned to the weaver; but being of a stronger and coarser texture, it requires more labour to get the fine fibres separate from the rest. Hence it is commonly employed in the more homely manufactures, and hempen cloth is seldom made finer than to serve for sheeting and shirts for the lower classes. It is the principal material of sail-cloth, a fabric the strength of which is required to be proportional to the violence it has to undergo from storms and tempests. Hemp is rendered still more important to navigation from its use in making cordage. For this purpose it is taken nearly in a raw state and twisted first into coarse twine, which is afterwards united to make rope;

rope; and several ropes twisted together go to form a cable, of strength and thickness sufficient to hold the largest man of war at her anchors. The consumption of hemp in a maritime nation like this is prodigious, on which account vast stores of it are constantly laid up in our naval arsenals. But we are now got beyond our proposed subject of materials for cloathing, so it is time to put an end to my letter.

Your affectionate, &c.

LETTER X.

VEGETABLE CLOATHING CONTINUED.

You have seen, my dear boy, that the inhabitant of the northern and temperate regions has been obliged to exercise much labour and contrivance in procuring his vegetable cloathing from the stalks of plants. In the meantime the native of the fruitful south has been enjoying the benefit of a material presented in greater abundance, and in a state requiring much less preparation before it is fitted for the manufacturer. This is *cotton*, a white woolly substance contained in the seed-pod of a family of plants, some of which are annual and herbaceous, others perennial and shrubby. The cotton-tree or plant is probably
a native

a native of the warm regions of Asia, in which it has from time immemorial served to cloathe multitudes of people. In the southern parts of Persia the shrubby kinds grow wild. But the cultivated cotton, both in the East and West Indies, in Lesser Asia, and in some of the warmer climates of Europe, is generally the herbaceous sort, produced from seed. Its culture is easy, and any soil suits it when once it has taken good root. In the West-Indies two crops of cotton are gathered in a year. The pods, when ripe, open of themselves, and the cotton is plucked out of them by the fingers, with the seeds sticking to it. These are separated by means of mills, which pull out and loosen the down. It is then in a state fit to be sent from the planter to the manufacturer. The further operations it undergoes are picking clean, carding, and roving, which last brings off the fibres longitudinally in
a con-

a continued loose line. These are next twisted and drawn out, so as to make thread, or yarn; and the material is then consigned to the weaver. The vast extension of the cotton manufacture in this country has caused these preparatory operations to be performed by a system of complex machinery, the invention of which has exercised all the ingenuity of the ablest mechanics. Dr. Darwin, in his "Botanic Garden," has given a highly poetical description of one of these cotton-spinning machines established on the bank of the Derwent in Derbyshire by the inventor, the late Sir Richard Arkwright. I shall treat you with some of the lines, in which you may admire the life and animation which he has given to a mere piece of machinery. But you should first read the explanation in prose.

"The cotton-wool is first picked by women from the pods and seeds,
(those,

(those, probably, which are left after the rough separation in the country where it grows.) It is then carded by *cylindrical cards*, which move against each other with different velocities. It is taken from these by an *iron-hand* or comb, which has a motion similar to that of scratching, and takes the wool off the cards longitudinally in respect to the fibres or staple, producing a continued line loosely cohering called the *rove* or *roving*. This rove, yet very loosely twisted, is then received or drawn into a *whirling-canister*, and is rolled by the centrifugal force in spiral lines within it, being yet too tender for the spindle. It is then passed between *two pairs of rollers*: the second pair moving faster than the first, elongate the thread with greater equality than can be done by the hand. It is then twisted on spoles or bobbins.”

Now for the lines :

First with nice eye emerging Naiads cull
From leathery pods the vegetable-wool;
With wiry teeth *revolving cards* release
The tangled knots, and smooth the ravell'd fleece;
Next moves the *iron-band* with fingers fine,
Combs the wide card, and forms the eternal line;
Slow, with soft lips, the *whirling can* acquires
The tender skains, and wraps in rising spires;
With quicken'd pace *successive rollers* move,
And these retain, and those extend, the rove;
Then fly the spoles, the rapid axles glow; [low.
And slowly circumsolves the lab'ring wheel be-

The fabrics made from cotton are probably more various and numerous than from any other material. They comprehend stuffs of all degrees of fineness, from the transparent muslin of a robe or a turban, to the thick plush and warm bed-quilt. The commerce of Great Britain has of late years been peculiarly indebted to the cotton manufactory, which produces cloathing for people of all ranks, from Russia to Guinea, and unites elegance with cheapness in an unrivalled degree. Great
quan-

quantities of the native fabrics of the East are also imported into Europe. Some of these, by the advantage of an excellent material, and incomparable manual dexterity and patience in the workmen, though made with very simple machinery, surpass in fineness and beauty any thing of European manufactory. The natives are said to perform their finest work in moist cool places under ground, which makes the cotton hold together so as to draw out to the thinnest threads; and the soft and delicate fingers of the Indian women give them the sense of feeling to a degree of nicety much beyond that of our common people.

It is probable that cotton, at present, clothes more people in the world than any other substance. Its peculiar advantage, besides cheapness, is the union of warmth with lightness, whence it is fitted for a great variety of climates. To the hot, it is better
G adapted

adapted than linen, on account of its absorbing quality, which keeps the skin dry and comfortable. The wooliness of cotton gives a kind of nap to the cloths made of it, which renders them soft to the touch, but apt to attract dust. In the fine muslins this is burned off, by passing them between heated cylinders with such velocity as not to take fire, which you may conceive, considering the combustibility of cotton, to be a very nice operation. A readiness to catch fire is, indeed, a dangerous quality of this material, and many fatal accidents have arisen from it since the prevailing use of muslins in women's dresses. Much mischief has also proceeded from colds taken in these delicate garments, which are by no means fitted to protect the wearers from the inclemencies of our variable climate.

The downy matter surrounding the seeds in some other plants has been

employed for the same purpose as cotton, and by proper preparation has, in some instances, succeeded very well; but, in most cases, it is too brittle, or of too short a staple, to be used with advantage in the form of thread. It has, however, afforded an useful material for stuffing beds and pillows, and for quilting. In this way the down of a plant growing copiously upon some of our bogs, called cotton-grass, has been employed by the neighbouring poor.

Having nothing further to add on vegetable materials for cloathing, I shall conclude my letter.

Your affectionate friend.

LETTER XI.

ON CLOATHING DERIVED FROM
ANIMALS.

My dear Boy,

I HAVE already suggested that one of the earliest notions of cloathing was probably that of a simple transfer of the covering of an animal to a human body. For this purpose, some animal well furnished with wool or hair would be fixed upon, and the hide would first be used in its natural state, that is, with the hair growing to the skin. In this state many are still used by the inhabitants of cold countries, both savage and civilized; and the elegant coverings of some of the smaller quadrupeds preserved in this condition, under the name of *furs*,

furs, make the most costly dresses of courts, and serve for distinctions of civil dignities. The fur of a black fox is a princely ornament in the North; and in our own country, the robes of royalty, nobility, and justice, are decorated with the spotless ermine.

In the hide of an animal, the hair and skin, however, are two entirely distinct things, and are to be considered separately as materials for cloathing. The *skin* is the proper integument of the body, serving to hold its parts together, and protect them from external injury. It is a moderately thick, tough membrane, elastic, extensible, and impenetrable to fluids. The *hairs* spring from roots just beneath the skin, pass through, and are strongly attached to it. The bodies of most quadrupeds are nearly covered all over with hairs, but they differ much in fineness and closeness. It is chiefly the smaller species which

are provided with those soft, thick, glossy coverings that bear the name of *fur*, and they are found in the greatest perfection where they are most wanted, that is, in the coldest countries. They form the riches of those dreary wastes which produce nothing else for human use; and their value has tempted men to expose themselves to the utmost hardships of cold and hunger while pursuing the chace amid perpetual frost and snow.

Many of the animals most esteemed for their fur are of the weasel kind: of these are the glutton, the martin, the sable, and the ermine. An amphibious quadruped called the sea-otter, frequenting the islands between Asia and America, and the north-western coast of the latter continent, has lately been in great request for its fur, which bears a high price in China. The principal countries for the production of furs are the solitary wilds of
Siberia,

Siberia, and the immeasurable forests of North America.

————— There, beneath the shining waste,
The furry nations harbour: tipt with jet,
Fair ermines, spotless as the snows they press;
Sables of glossy black; and dark embrown'd,
Or beauteous freak'd with many a mingled hue,
Thousands besides, the costly pride of courts.

Thomson.

Fur is used either growing to the skin, or separated from it. In the first case it is necessary to preserve the skin from decaying or putrefying. This, in the smaller furs, is easily effected by first cleansing them well, and then hanging them to dry in the wind. The larger are besides dressed with some astringent powder on the inside. Furs in this state are most commonly used for the lining or facing of garments, and are sewn on to the other material in slips or patches.

Fur, in its detached state, is usually

employed in making a stuff called *felt*. The operation of *felting* depends upon a peculiarity of structure in all hairs, which, however smooth and uniform they may seem to the eye, have in reality a scaly or tiled texture on the surface. The scales are so disposed, that they make no resistance to the finger drawn along the hair from the root to the point, but cause a roughness and resistance in a contrary direction. From this property, hairs, when beaten or pressed together, are disposed to catch hold of and twist round each other, and thus to cohere into a mass. It is in the manufacture of hats that felting is chiefly practised. The fur used for this purpose is that of the beaver, the rabbit, and the hare. This consists of two sorts of hair, a long stiff kind, with a short, close, soft down beneath. It is the latter which alone is used in felting. Wool is likewise employed in the coarser
sorts

forts of felt, and it has the particular advantage of being naturally so bent and curled, that each hair takes ready and firm hold of its neighbour. Wool, before felting, is well cleansed of oil and grease, and is cut into small lengths. The fur or wool is then carded; after which, a proper quantity of it is laid upon a square table having chinks cut through it lengthwise. The workman now takes an instrument called a bow, which is like a fiddle-stick, but much larger; and with the string of this he strikes upon the material, making all the hairs successively fly up and mix together, while the dust and refuse pass away through the chinks of the table. After he has by this operation worked the material into an equal and consistent layer, he covers it with a cloth or leather, which he presses with his hands in different directions, so as to render the texture

of the stuff beneath firmer and closer, and cause the hairs to take stronger hold of each other. He then lays the stuff upon an iron plate slightly heated by a fire beneath, sprinkles it with water, applies a kind of mould upon it, and thus, by heat and pressure, it becomes a hairy felt, though as yet but of a loose texture. A number of other operations are to be performed before it acquires the firmness which you find in a hat; particularly, stiffening it by means of glue or gum; but it is not my purpose to give you an accurate description of this manufacture. It is enough if you comprehend in general how the detached hair of fur or wool is made to cohere into a firm stuff, merely by intermingling.

The longer hairs of animals are employed in making woven stuffs of various kinds; but I shall reserve
what

what I have to say of these till I have given you an account of the woollen manufactory. This will form the subject of my next letter. For the present, adieu!

LETTER XII.

ON THE WOOLLEN MANUFACTORY.

OF all the materials for cloathing afforded by animals, the wool of the sheep has been preferred by the greatest number of people in all ages. This useful and innocent creature has been domesticated in all the climates of the globe between the extremes of heat and cold; and in all, it has not only bestowed upon man its flesh for his nourishment, but its fleece for his covering. The skin with the wool growing to it has been the dress only of savages, or of tribes little advanced beyond them. Wherever civilization has prevailed, the wool, plucked off or sheared from the skin, has been employed as a material for the fabrication

cation of cloths of different kinds. This wool, you know, may be taken from the living animal at the approach of summer without hurting it; and is annually renewed. Sheep-shearing is one of the most interesting of the rural occupations, and has afforded a subject of pleasing description to several poets, particularly to Dyer, whose principal poem is entitled *The Fleece*.

Wool differs from common hair in being more soft and supple, and more disposed to curl. These properties it owes to a degree of unctuousity or greasiness, which is difficultly separated from it. Its qualities in respect to fineness, length of staple, colour, &c. differ greatly in different breeds of sheep, and even in different parts of the same fleece. Peculiar attention has been paid to the selecting of such breeds as yield the best wool for different purposes, and treating the animal so as to improve it to the highest possible

fible degree. The Spanish wool is allowed to be the finest that Europe affords. Probably some of the English kinds excel all others in length of flake. There is, indeed, no kind of wool of which very good samples are not to be found in this island, for nowhere have more pains been taken to vary and improve the breeds of sheep. The whole wool, as taken from the animal's body, is called a *fleece*. The first operation this undergoes is that of picking and sorting into the different kinds of wool of which it is composed. These are next to be cleansed from marks and stains, and freed from their offensive greasiness. The practice of using tar in marking sheep, and also in dressing their sores, is the cause of the waste of much wool from the difficulty of getting it out again, and should therefore be avoided as much as possible. When the wool is cleansed, it is delivered to the wool-comber, who,
by

by means of iron spiked combs of different fineness, draws out the fibres, smooths and straightens them, separates the refuse, and brings it into a state fit for the spinner. In his operations he is obliged to use a good deal of oil, which is afterwards to be washed out. The spinner forms the wool into threads, which are more or less twisted, according to the manufacture for which they are designed. The more twisted is called *worsted*; the looser, *yarn*.

The kinds of stuffs made wholly or partly of wool are extremely various; and Great Britain produces more of them, and in general of better quality, than any other country in Europe. Our broad cloths form the principal article of the dress of men of the superior classes; and a more perfect manufacture, with respect to beauty and utility, cannot easily be conceived. The threads in it are so concealed by a fine nap or down raised on the surface,

face, and curiously smoothed and glossed, that it looks more like a rich texture of nature's forming, than the work of the weaver. It is to be observed that wool, in common with other animal substances, takes a dye better than any vegetable matters. Our cloths are therefore made of every hue that can be desired; but in order to fit them for the dyer, they must be first freed from all greasiness and foulness. This is done by the operation of *fulling*, in which the cloths are beaten by heavy mallets as they lie in water with which a quantity of clayey earth has been mixed. The best earth for this purpose is called fuller's-earth, of which there are pits in several parts of England. It unites with the greasy matter, and renders it soluble in water; so that by continually supplying fresh streams while the beating is going on, all the foulness is at length carried off. You have

have probably seen fuller's-earth employed in a small way in getting the greafe-spots out of your cloaths. The operation of fulling has the further effect of thickening the cloth, and rendering it more firm and compact, by mixing the threads with each other, something in the manner of a felt.

The cloths of inferior fineness are mostly called narrow cloths, and are made of all qualities as to strength and thickness. Some of those used for great-coats, by their substance and shagginess, resemble the original fleece, or rather the fur of a bear, and render unnecessary the use of furred garments among us. Indeed, with the single material of wool, art has been able much better to suit the different wants of man in his cloathing, than can be done by all the productions of nature. What could be so comfortable for our beds as blankets? What so warm, and at the same time so light, for pained
and

and palsied limbs, as flannel? The several kinds of the worsted manufacture are excellent for that elasticity which makes them fit close to a part without impeding its motions. This quality is particularly observable in flockings, of which article of dress, most of those worn by the inferior classes, and, in winter, by the superior, are made of worsted. The making of these by the simple machinery of knitting is, you know, a common domestic manufacture. In the large way, they are wrought by a curious engine called a frame. Even the thinnest of the woollen fabrics possess a considerable degree of warmth, as appears in those very delicate cloths called shawls. The real shawls are made of the fine wool of Tibet, in the eastern part of Asia, and are sold at higher prices than almost any other wearing manufacture. They have, however, been well imitated by the product

product of some of our English looms. A very different article made of wool, yet equally appropriated to luxury, is carpeting. This is rather cloathing for our floors than ourselves, but our feet receive the benefit of its warmth. In the East, soft carpeting is placed all round the room, upon which the natives recline or sit cross-legged, instead of using chairs; and the beauty and richness of their carpets is a principal part of their domestic finery.

It has already been remarked that the use of linen or cotton garments next to the skin, instead of woollen, is an improvement, since wool has always somewhat of a fretting irritating quality, causing itching and eruptions. Hence it should never touch naked wounds or sores. In cold and damp countries, indeed, flannel keeps up an equable warmth and dryness which is very salutary, and on that account it has been much recommended

mended for delicate constitutions.
Upon the whole, Dyer's praise of
wool seems to have a just foundation.
Speaking of materials for cloathing,
he says,

Still shall o'er all prevail the shepherd's stores,
For num'rous uses known: none yield such
warmth,

Such beauteous hues receive, so long endure:
So pliant to the loom, so various, none.

So much for the woollen manufac-
ture, the importance of which renders
it a subject sufficient for a single letter.
You shall shortly hear from me again;
meantime, farewell!

LETTER XIII.

ANIMAL CLOATHING CONTINUED.

SILK.

My dear Boy,

I HAVE already hinted that the hair of other animals besides the sheep has afforded a material for woven stuffs employed in cloathing. Those quadrupeds in South America called by the names of glama, vicuna, and paco, and which modern naturalists rank with the camel, though much smaller, are covered with a wool resembling that of the sheep, and applied to the same purpose. Of these, Dr. Shaw says that “the vicuna seems to afford the finest wool of any, and is wrought into cloths of most exquisite silky softness and beauty, which are said to be
too

too warm for common wear, unless made peculiarly thin." If this were procurable in any quantity, it might be a valuable article in our northern climates, where we should probably have no reason to complain of its warmth in winter.

The Angora goat is covered with hair of remarkable beauty. It is milk-white, glossy, and formed into long spiral ringlets. Such a promising material could not long be overlooked; accordingly we find that it has given rise to the manufacture of the finest camlets and other stuffs for which that district in Lesser Asia is noted. The hair of the camel is also woven into stuffs for various purposes. Hair-cloths, indeed, are made from long hair of any kind; but those, in general, are too harsh and rough for cloathing, and are employed in other services. I suppose it will not much recommend this manufacture to you,

to be told that some superstitious people, who fancied that tormenting themselves in this world would entitle them to the favour of their maker in another, have thought it a good expedient to wear hair-cloth shirts.

Men must have been far advanced in civilization and the observation of nature, before they found out a material for cloathing in the labours of a caterpillar. China, one of the oldest-peopled countries of the globe, and in which the arts of life have longest arrived at a high degree of perfection, appears to have been the first to make use of the web spun by the *silkworm*. This creature, which, in its perfect state, is a kind of moth, is hatched from the egg in form of a caterpillar, and passes from that state successively to those of a nymph or chrysalis, and of a winged insect. While a caterpillar, it eats voraciously, its proper and favourite food being the leaves of the

the

the different species of mulberry. By this diet it is not only nourished, but is enabled to lay up, in receptacles within its body formed for the purpose, a kind of transparent glue, which has the property of hardening as soon as it comes into the air. When arrived at full maturity, it spins itself a web out of this gluey matter, within which it is to lie safe and concealed during its transformation into the helpless and motionless state of a chrysalis.

I shall here step out of my way to remark, that there is not in nature a more striking example of what is called *instinct* in animals, than this fact of the webs spun by most of the caterpillar tribe. By *instinct* is meant an impulse to actions, of which the end or purpose is not foreseen by the performer, and which are not the consequence of instruction or imitation. Now, the caterpillar has never been

6
taught

taught by a parent, since it is not hatched from the egg till many months after all of its species are dead. Nor can it possibly, without the gift of prophecy, discern any use in spinning itself a temporary tomb, which it is to occupy under a new state of being. It works, therefore, in consequence of a blind impulse directing its plan and motions, for which we have no other name than that of an *instinct*: and I do not see how philosophers can refuse to admit the reality of such a principle, how much soever they may be puzzled to account for it.

To return to our subject——The silkworm's web is an oval ball, called a cocoon, of a hue varying from light straw colour to full yellow, and consisting of a single thread wound round and round, so as to make a close and impenetrable covering. The thread is so very fine, that when unravelled it has been measured to 700 or 1000 feet,

feet, all rolled within the compass of a crow's or pigeon's egg. In a state of nature, the silkworm makes its cocoon upon the mulberry-tree itself, where it shines like a golden fruit among the leaves; and in the southern parts of China, and other warm countries of the East, it is still suffered to do so, the cocoons being gathered from the trees without further trouble. But in even the warmest climates of Europe, the inclemencies of the weather in spring, when the worms are hatched, will not permit the rearing them in the open air. They are kept in warm but airy rooms, constructed for the purpose; and are regularly fed with mulberry leaves till the period of their full growth. It is a matter of nicety to keep back the hatching of the eggs till the season is far enough advanced to afford mulberry leaves. As this tree is one of the latest in leafing, silkworms cannot advantageously

ously be reared in cold climates. During their growth, they several times shed their skins, and many die under this operation. At length they become so full of the silky matter, that it gives them a yellowish tinge, and they cease to eat. Twigs are then presented to them upon little stages of wickerwork, on which they immediately begin to form their webs. When the cocoons are finished, a small number, reserved for breeding, are suffered to eat their way out in their butterfly state: the rest are killed in the chrysalis state by exposing the cocoons to the heat of an oven.

The next business is to wind off the silk. After separating a downy matter from the outside of the cocoons, called *floss*, they are thrown into warm water; and the ends of the threads being found, several are joined together, and wound in a single one upon a reel. This is the silk in its natural state, called *raw silk*.

It next undergoes some operations to cleanse and render it more supple; after which it is made into what is called *organzine*, or *thrown silk*, being twisted into thread of such different degrees of fineness as are wanted in the different manufactures. This is done in the large way by mills of curious construction, which turn at once a vast number of spindles, and perform at the same time the processes of unwinding, twisting, reeling, &c. The largest and most complicated machine for this purpose in England, is at Derby, the model of which was clandestinely brought from Italy, in which country all the branches of the silk manufacture have long flourished.

The excellence of silk as a material consists in its strength, lightness, lustre, and readiness in taking dyes. It is likewise very little apt to be preyed upon by insects. When little known in Europe, it was highly prized for its

rarity: it is now esteemed for its real beauty and other valuable qualities. As it can never be produced in great abundance, it must always be a dear article of cloathing. Silkworms are reared from China quite through all the warm and temperate climates of Asia, and in the southern parts of Europe. France is the most northern country in which silk is produced in any quantity. In England, though silkworms are bred without much difficulty by way of experiment, yet the dearness of labour prevents the production of silk from being an object of profit. What is used in our manufactures comes chiefly from China, Persia, and Lesser Asia in a raw state, or from Italy in that of organzine. The fabrics of silk are very numerous, and almost all devoted to the purposes of show and luxury. In thickness they vary from the finest gauze, to velvet, the pile of which renders it as close and

warm as a fur. Some of the most beautiful of the silk manufactures are the glossy tatin; the elegant damask, of which the flowers are of the same hue with the piece, and only show themselves from the difference of shade; the rich brocade, in which flowers of natural colours, or of gold and silver thread, are interwoven; and the infinitely varied ribbons. It is also a common material for stockings, gloves, buttons, strings, &c. in which its durability almost compensates for its dearth. Much is used for the purpose of sewing, no other thread approaching it in strength. Silk, in short, bears the same superiority among cloathing materials, that gold does among metals: it gives an appearance of richness wherever it is employed, and confers a real value. Even the refuse of silk is carefully collected, and serves for useful purposes. The down about the cocoons,

and

and the waste separated in the operations raw silk undergoes, are spun into a coarser thread, of which very serviceable stockings are made. The interior part of the cocoon is reckoned to be the best material for making artificial flowers.

As I have mentioned that the greatest part of the caterpillar tribe spin themselves similar webs, you will perhaps wonder that none of these have been employed like that of the silkworm. Some trials have, in fact, been made; but these other insect-webs have all either proved inferior in quality to the true silk, or cannot be procured in quantity sufficient to render them an object of attention. But you will be surprised to be told that the product of a shell-fish residing at the bottom of the sea is actually employed for the same purposes. This is a species of large muscle, called *pinna marina*, found on the coasts of

Naples, Sicily, Minorca, and other islands of those seas, which, by means of some wonderful contrivance of nature, has the faculty of spinning from its body certain fine brown threads, by which it fastens its shell firmly to the rocks. These threads collected form a remarkably fine kind of silk, of which, stockings, gloves, and other articles, in small quantities, are manufactured by the people on those shores.

But this is a proper place for a pause; so, farewell!

LETTER XIV.

THE MANUFACTURE OF LEATHER.

You remember that on first mentioning the hide of animals as a material of cloathing, I distinguished between the covering of the skin, and the skin itself. Having now gone through the principal uses made of the former, I proceed to give you some acquaintance with the methods employed to render the latter useful. The nature of this integument of the body, I have already described to you; and it is not to be wondered at that men should soon have sought an additional garment, in that substance by which they found their own bodies naturally protected. The tough hide

of the wild beast, which it had cost the ancient hero so much pains to pierce, would readily suggest itself to him as an excellent defence from the blows of other warriors, or from the injuries he might sustain in passing through tangled forests or amid rugged rocks. The resistance made by the skin to hurts and wounds is, indeed, in some animals very surprising. Thus the badger, whose skin adheres very loosely to the flesh, can scarcely be destroyed by the teeth of the dogs set to worry it, but will retain life after undergoing for hours the severest baiting.

The difficulty would, however, immediately occur, of preserving the skin stript from the animal, in a state fit for use. If nothing were done to it, like all the other soft parts, it would soon grow putrid; and if this were prevented by drying, it would become hard and shrivelled. What art, therefore

fore, has attempted in its preparation, has been to impregnate it with a matter capable of preserving it from putrefaction, and at the same time to keep it in a state of flexibility and suppleness. When this is effected, skin becomes *leather*,—a substance of the highest utility, as well in cloathing, as for numerous other purposes. The art of preparing leather consists of a variety of processes, some of them tedious and complicated. I shall not pretend to do more than give you a general notion of these; and first, of the principal operation, called *tanning*.

The hide taken off with due care by the skinner, is first thrown into a pit with water alone, in order to free it from dirt. After lying a day or two, it is placed upon a solid half-cylinder of stone, called a *beam*, where it is cleared of any adhering fat or flesh. It is then put into a pit containing a mixture of lime and water, in which

it is kept about a fortnight. The intent of this is to swell and thicken the hide, and to loosen the hair. Being now replaced upon the beam, the hair is scraped off; and it is next committed to the *mastering-pit*. The contents of this are some animal dung (hen's or pigeon's is preferred) and water; and its operation is to reduce that thickening which the lime had given. After this is effected, it is again cleansed on the beam, and is then put into the proper tanning liquor, called the *ooze*, which is an infusion of coarsely-powdered oak-bark in water. The bark of the oak, as well as every other part of it, abounds in a strongly-astringent matter; and it is the thorough impregnation with this which preserves the hide from decay or putrefaction. Other vegetable astringents will equally serve the purpose, and are used in some countries; but with us, none is found so strong and so plentiful as that yielded

yielded by the oak. A weaker ooze is first employed, and the hide is frequently turned and worked in it. It is then removed to a stronger; and lastly into the most powerful, with fresh bark: and these different steepings take up a considerable time, greater or less according to the size of the hide and other circumstances. When at length it is thought to have imbibed enough of the astringent matter, the hide is taken out and hung upon a pole to drain, after which it is put upon a piece of wood with a convex surface called a *horse*, on which it is stretched, and kept smooth and even. Finally it is taken to the *drying-house*, a covered building with apertures for the free admission of air; and it is there hung up till it becomes completely dry; and thus the process of tanning is finished.

From the tanner, the hide or skin is consigned to the *currier*, whose art is

is further necessary in order to make it perfect leather. He first soaks it thoroughly in water, and then places it upon a *beam*, made of hard wood, with one side sloping and polished. He lays it with the grain side, or that on which the hair grew, inwards, and the flesh side outwards. He then, with a broad two-edged knife having a handle at each end, shaves or pares the hide on the latter side, till all its inequalities are removed, and it is reduced to the degree of thinness required for use. After this operation it is again put into water, then scoured, and rubbed with a polished stone. It is next besmeared with a kind of oil procured from sheep- or deer-skin, or made by boiling train-oil and tallow together; the intention of which is to soften or supple it. A great part of its moisture is then evaporated by hanging it up in a drying-house for some days; and it is further dried by exposure to the sun,

or

or to the heat of a stove. It is then differently treated according as it is meant to be blacked or stained, or not. Without entering into minute particulars, it is enough to observe, that the astringent principle with which the leather has been impregnated in the tanning, renders nothing necessary except the application of a solution of vitriol of iron, at once to strike a deep black. This is laid on with a brush, generally on the grain side of the leather; and it afterwards undergoes the operation of giving it that roughness which is called the *grain*. This is performed by rubbing it in all directions with a fluted board. When leather is blacked on the flesh side, the colour is given by a mixture of lamp-black and oil.

It is in the manner above described that leather is prepared for the making of shoes and boots, which is one of the principal uses of this material ;
and

and certainly no other substance could so well unite strength and suppleness, with the property of keeping out water. Good shoes are one of the most necessary articles of dress for health and comfort, to those who go much abroad; nor has human industry in many cases more happily exerted itself than in discovering the most perfect mode of answering the purposes required in this manufacture. The great length of the process, however, has put many persons upon experiments to abridge it; but though this may perhaps be done to a certain degree, yet it is probable that time, in this instance, as in many others, will effect what no substitute can do; and that the long and numerous soakings are necessary thoroughly to impregnate the hide with the preservative matter, without injury to its texture. Leather is capable of being dyed of various colours besides black, by means of different drugs.

Some

Some tanned leather is likewise dressed white, or of a tawny hue, as you see in leathern breeches. These variations, however, I do not mean to enter into. The hides principally used in the shoe-manufacture, are those of neat-cattle, or the ox kind. For the more delicate work, the skins of the goat, dog, seal, and some other animals, are employed. For breeches-leather, deer-skin is preferred; and the best tanned gloves are made with the same.

There is another mode of preparing leather, quite different from the preceding, which is called *tawing*. It is chiefly practised upon kid-skins, for the manufacture of fine gloves. The skin is first washed, and then soaked in lime-water in order to get rid of the hair and grease. It is then softened in warm water and bran, and stretched out to dry; which renders it transparent. The preservative liquor is next applied, which is here not a vegetable astringent,

astringent, but a solution of alum and common salt. With this it is impregnated so as to admit of keeping in that state several months. The next operation is to wash out the superfluous salts with warm water, which must be done with great nicety. Afterwards, it is moderately dried, and then thrown into a tub in which yolks of eggs have been well mixed by beating. The skins are trodden in this, till all the egg is incorporated in their substance, which is thereby rendered more solid, and at the same time soft and pliable. Blood is sometimes for cheapness used instead of eggs, but it communicates a colour which cannot be entirely discharged. The skins are then dried again, when they become fit either for taking a dye, or for being glossed if preserved white. The method of preparing goat-skins for the celebrated morocco leather resembles this; but the thickening matter in which the
skins

skins are trod is a bath of white figs with water.

It would be easy to lengthen this letter by descriptions of other methods of preparing skins, as practised in different countries with greater or less simplicity ; but I hope I have said enough to afford you clear ideas of the leading purposes in view, and the essential operations for effecting them. I will therefore keep you no longer upon this manufacture, which, though curious, is not one of the most pleasing. I now, likewise, conclude the whole topic of the arts concerned in cloathing.

With sincere wishes for your pleasure and instruction, I remain

Yours affectionately.

LETTER XV.

ON THE ARTS OF PROVIDING
SHELTER.

And teach us further by what means to shun
 'Th' inclement seasons, rain, ice, hail and snow.

Par. Lost.

My dear Boy,

It is not of great importance to ascertain the exact order in which the different arts of life were introduced among mankind; else it might be contended that the want of shelter from the storm would be felt earlier than that of cloathing, at least in a warm climate. A place of refuge during the darkness of the night, while beasts of prey were roaming about for food, would also immediately appear desirable.

desirable. The example of the brute animals themselves, too, would soon attract the notice of the human savage. Few of these are unprovided with a lodging or habitation of some kind for nightly repose, or as a retreat from the inclemencies of the weather. Some make holes under ground, which they have even the skill to scoop into chambers or apartments for different purposes. Some occupy the natural clefts or caverns of rocks. Some form their dens amid the thickest growth of underwood in the forests. The tribe of birds are particularly remarkable for the art they exercise in framing their nests, some of which display extraordinary marks of contrivance. Yet insects sometimes exhibit a still greater degree of skill; and the covered galleries of the ant, and cells of the bee, may vie with the most studied productions of human ingenuity.

Man, thus urged by necessity and
instructed

instructed by example, would not be long in employing his reason to procure himself similar advantages. As, in a savage state, he seldom chooses to give himself more trouble than is absolutely necessary, he would first, perhaps, only share with the beasts their natural shelter in the rocks. The want of tools would be an impediment to his progress; but if he was situated near a rocky bank of soft crumbling stone, he would soon find himself able, by the help of a sharp hard stone, to hollow it out into winding passages and chambers beyond the reach of the driving storm, and capable of being secured from attacks. Whole nations are recorded to have lived in habitations of this sort; and even in the midst of civilized society, the convenience of such a mode of lodging has caused it to be continued. Thus, the French poet Boileau, in the splendid age of Lewis XIV. has described the hamlet

of which he was the lord, not forty miles from Paris, in lines of which the following are a translation :

The village rises in theatric show,
Whose simple sons nor lime nor plaster know ;
But in the yielding rock, with self-taught hands,
Each scoops the cell his humble life demands.

Similar habitations are now possessed by some of the poor in the town of Bridgenorth.

This expedient would on many accounts be more eligible than that to which the natives of the coldest-inhabited regions of the globe are through necessity driven ; which is, to imitate the animals of the country, and make a kind of burrow under the surface of the ground. In these subterraneous apartments they are, indeed, well protected from the cold, and out of the reach of the howling tempest ; but they can have no light but from lamps, and no convenience for getting rid of the filth which must accumulate during
their

their tedious winters. In this respect they are less comfortable than their fellow-burrowers of the brute creation, which generally lie torpid in the winter-season, and feel none of the necessities of nature. The stench and closeness of these under-ground huts are said to be absolutely intolerable to any but the natives, who, through habit, seem to be little affected by such inconveniencies.

In the warm climates, however, which were probably the original seat of man, amid the exuberant growth of forests, the first permanent shelter made by his hands would naturally be a kind of close arbour, formed of inter-twisted boughs, impenetrable to the rain over head by its own green foliage in summer, and by dried grass, moss, and the like, in the winter. Milton has given a delightful description of a bower of this sort, the supposed habitation of our first parents in Paradise.

_____The roof
 Of thickest covert was inwoven shade
 Laurel and myrtle, and what higher grew
 Of firm and fragrant leaf; on either side
 Acanthus and each od'rous bushy shrub
 Fenc'd up the verdant wall; each beauteous
 flower,
 Iris all hues, roses and jessamin,
 Rear'd high their flourish'd heads between, and
 wrought
 Mosaic; underfoot the violet,
 Crocus and hyacinth with rich inlay
 Broider'd the ground. — *Par. Lost*, iv.

Such a dwelling, however, though
 extremely poetical, would be found
 rather too unsubstantial for domestic
 purposes, and art would presently sug-
 gest improvements upon it. As soon
 as means had been discovered of cut-
 ting down and shaping the trunks and
 branches of trees, the artificial hut or
 cabin would on many accounts be pre-
 ferred to the natural arbour. As this
 is, in fact, the origin of all edifices
 for habitation up to the palace, I shall

consider it at some length, in its various steps towards perfection.

The rudest structure of this kind seems to be that which is still the only habitation occupied by some human beings, and which consists of a few poles set in a circular form, and meeting at top. Upon these are fastened leafy branches, pieces of bark, turf, or the like, so as to give some protection from the descending shower. An entrance is left open on that side which is least exposed to the cold winds ; and to correct the chillness of the night-air, a fire is kindled on the ground facing the entrance, and the inhabitant takes his repose stretched within his cover, presenting his naked feet towards the grateful flame. It is impossible for shelter to be more cheaply provided by art than by such a contrivance.

The *shed* is a small advance beyond
the

the preceding in point of comfort. This supposes an upright back already provided, from which is thrown a sloping roof, resting upon a front and sides. Nothing can possibly be more simple than the manner in which that extraordinary race, the gipsies, construct a dwelling of this kind. They seek out a wide dry ditch, backed on one side with a high bank. From the top of this to the lower opposite side, they lay a row of rough poles, which they cross with leafy boughs, wattled in, so as to form a sloping roof, capable of keeping out and carrying off a shower of rain. One of the ends they close in with poles wattled in the same manner: the other, they leave open for an entrance. The hollow of the ditch is their apartment, strewed perhaps with fern or withered leaves, in which they lie at least as snug as a hare in her form. It must be allowed, however, that they are not entitled to all

the merit of this ingenuity, for the ditch is ready dug to their hands. When these people aspire to a hut or hovel, their contrivance goes little further. They stick in the ground a row of flexible poles or stakes, which they bend round so as to make an arch. This they cover with an old canvas tilt, like that of a carrier's waggon, and, creeping under it, find their lodging sufficiently ample. But this, again, is not all their own; for they must beg or steal the canvas, which is the most material part of the fabric. Indeed, such a habitation rather partakes of the nature of a *tent*, which is scarcely to be reckoned among the proper building contrivances, since almost the whole art exerted in it consists in the fabrication of the stuff which is made to serve as a shelter.

The real *hut*, or rustic house, as first made by the native of a woody country, must have been constructed of the material

material ready provided to his purpose by nature, namely, timber, or wood. This substance possesses many excellent qualities for the builder's use. It combines strength with lightness, toughness with flexibility: it is readily fashioned by the workman's tool, yet has sufficient hardness to resist external violence, or the decaying effects of air and moisture, at least for a considerable time. The trunks of trees, presenting a kind of natural columns capable of supporting the vast weight of the branching heads, would then be selected for the frame of the intended fabric. They would be taken of such a size as the workman could easily manage, stripped of their branches, pointed, and driven into the ground at suitable distances. Probably, four main posts set in a square or oblong form would afford space enough for the first humble dwelling. These would be connected by four smaller trunks or beams laid

horizontally on their tops, and fast bound with slips of bark or tough twigs. The intervals between the posts would be filled up with slenderer upright poles stuck in the ground, and interwoven cross-wise with sticks or boughs, so as to make a sort of wicker-work. And as this could not be made quite close, the contrivance would soon suggest itself of stuffing its chinks with moss, and daubing the surface over with moist clay, which might harden in the sun. The roof would at first be a flat one, made by laying poles, by way of rafters, across the beams, and upon these, branches of trees with the leaves on, with dried grass, reeds, or the like. In hot climates, the large broad leaves of the palmetto or other similar trees would offer a ready covering. It would soon be found, however, that the water of a very heavy shower, lodging upon a flat roof, would soak through, notwithstanding

withstanding all the pains that could be taken. The obvious remedy for this would be a sloping roof, to carry off the rain as it fell; and this would easily be formed by making the hinder posts of the hut taller than the front ones, whereby the side beams, the rafters, and the whole roof, would take an oblique direction from the back to the front.

The entrance of the habitation would vary according to the climate, and the security requisite against unwelcome intruders. In a hot country, not infested with dangerous animals, perhaps the builder would leave one of the shorter sides quite open; but where the cold or the attacks of wild beasts were to be guarded against, he would leave only a small aperture, probably not so high as himself, which he would contrive to close occasionally by a strong hurdle, or a bundle of sticks. This, at first, would also be

the only inlet for light, and outlet for the smoke of his fire; but, for the latter purpose, he would soon find it more convenient to make a hole in the roof. The ascending quality of smoke, and the advantage of providing an escape for it while his door remained safe shut, would suggest this improvement.

Huts similar to those I have been describing are at this day in use, not only among savage nations, but among the new settlers in the wilds of America, who are obliged to pass some years in a state little removed from that of savages, till by the culture of the ground they are able to improve their condition. Their *log-house* is an edifice of rough timber, made of trunks or poles of equal lengths laid horizontally upon each other, and fastened at the ends into upright posts by means of notches or mortises. The crevices are plastered with clay mixed with

with moss or straw. The roof is made either of bark or split boards: the fire-place is a hollow pile of stones, above which a hole is left in the roof for the smoke to pass out. Another hole is made in the side for a window, which is occasionally closed with a wooden shutter. Thus a place of shelter is procured, sufficient to answer every necessary purpose, though destitute of most of the comforts and conveniences which we are so happy as to enjoy in our habitations. In what these principally consist will be the subject of my next letter.

Your truly affectionate, &c.

LETTER XVI.

ARTS OF SHELTER CONTINUED.

IN my last letter I proceeded as far as the substantial log-house of an American settler ; but I must now go back a little to consider the expedients practised by the inhabitant of a bare and open country, who needs shelter the more, in proportion as nature has the less provided it in surrounding objects. The turfy covering of the earth, or the stones encumbering its surface, are the only materials presenting themselves for the erection of his humble hut. These he piles up so as to form four thick walls, the crevices of which he stops up with moss or clay. From the top of them he springs his roof, which he cannot well make without

a few poles or beams for rafters. His covering is either green fods, or twigs of heath, which he binds on with ropes twisted from long grafs, and strengthens by the weight of large flat stones. Thus, in some snug hollow, he defies the wintry blast which howls around, and rears securely his hardy offspring. Of fuch habitations in their very rudeft form you may fee specimens in Mr. Pennant's Tour to the Western Ifles of Scotland.

But though human beings may exift with no better provision for fhelter than thofe above defcribed, yet an attention to the comforts and conveniences of life would foon fuggelt a variety of improvements. Before I attempt to give you a general notion of thefe, it will be proper to fpeak of thofe additional materials for building which art has difcovered, or has employed to much greater advantage than as they are prefented by nature.

The art of the carpenter in squaring timber, dividing it into thin boards, smoothing it, fastening pieces together by mortises and dove-tails, and other devices for fashioning it to all sorts of purposes, has so much increased its usefulness as a material, that numberless conveniences have been produced by its means, which the wild inhabitant of the woods could never have thought of.

For the walls of a building, stone obviously presents the strongest and most durable material; but the scattered stones upon the surface of the ground are too irregular in their form to fit closely together, and make a solid fabric. Art, therefore, had recourse to the great masses of stone lying upon the earth and stretching beneath its surface; and, by means of proper tools, cut out of them regular pieces of convenient sizes, which, when duly shaped and smoothed,

3

might

might be applied to each other, so as to raise a structure perfectly firm and even. The best kinds of stone for the mason's use are those called *freestones*; which name is given them from the freedom with which they yield to the stone-cutter's tools while in the quarry, although they become hard upon exposure to the air. The composition of these stones is sand and calcareous earth, bound together by a natural cement. Other sorts are harder and more durable, but the difficulty with which they are wrought is reckoned to overbalance this advantage. The practice of working quarries is of very remote origin, and the remains of many ancient edifices still exist, which astonish by the vast bulk of the single stones of which they are composed, and prove the excellence of the material.

Stone also affords one of the best materials for the covering of buildings. The species principally used for this purpose

purpose is *slate*, a kind of stone naturally disposed in layers, and which separates into thin broad leaves under the tool of the workman. Slate is of various colours and degrees of fineness. That which divides into the thinnest leaves is in general to be preferred, since, with sufficient solidity to resist the weather, it makes the least addition to the weight to be supported by the roof. Considerable skill is required in laying it on, so that the lower end of one slate may just lap over the upper end of another, and fit so closely that no wet can beat in between; and also that the wind may have as little hold of it as possible. Such a covering both answers the purpose very effectually, and is very durable; and where slates of a good kind are to be procured upon moderate terms, houses are seldom covered with anything else.

It is the business of art not only to employ the gifts of nature to the best advantage,

advantage, but to find substitutes for them where they are wanting. When the comfort of a stone building had been experienced, men set about discovering some other material which might supply its place in countries where it could not be procured. It was soon found that earths of the clayey kind possessed the property of becoming hard in the fire ; and as, in their soft state, they might be moulded into any shape, an opportunity was plainly given of forming a sort of artificial stones, more easily brought to the desired regularity than the natural ones. The art of *brick-making* was therefore one of the early inventions of mankind. We are informed that it was practised among the ancient Egyptians ; and the stupendous walls of Babylon were constructed of bricks. In hot countries, where rain seldom fell, the heat of the sun was thought sufficient to give the clay a due degree

gree of hardnefs ; and to this day many towns and villages in the East are built with bricks baked in the fun, in confequence of which, a heavy unexpected ſhower will waſh down whole houſes. The ſubſtantial way has always been to burn them with fuel ; and this is done ſometimes in buildings called kilns, and ſometimes in piles raiſed in the open air, in which the raw bricks, or regular ſhapes of clay made in a mould, are diſpoſed ſo as to leave a kind of channels for the fuel, all communicating with a fire-place at the bottom of the pile. The heat is applied gradually, and is continued till the whole have acquired a hardnefs which ought to be equal to that of a natural ſtone. The qualities of bricks are very various according to the nature of the clay, and the pains taken to burn them thoroughly. The pale bricks generally uſed in London, made of a mixture of clay, dirt, and

and coal-ashes, are some of the worst, and promise but a short duration to the edifices of the metropolis. Good brick is a very valuable material for building. It is cheaper and more handy for use than squared stone, and yet equally well resists the impression of the weather, and secures from the danger of fire.

When baked earth had been employed for the walls of an edifice, it was an obvious matter to use it also for the covering. For this purpose the clay is moulded into thin oblong pieces called *tiles*, some flat, others bent like a scrowl, and sometimes glazed on the outer surface. These are laid upon the roof like slates, and, being regular in their shape, are capable of fitting very exactly to each other, and forming a neat and effectual covering. They have the fault of being brittle, and are heavier than an equal surface of fine slate.

A very

A very important article of the artificial building-materials remains to be described, which is, the *cement*. Stones or bricks merely piled upon each other would make a very loose wall, easily thrown down, and penetrable by the wind and rain. It was therefore necessary to find some substance which would completely fill up the chinks, and then, by hardening, would bind all the pieces together, so as to form, as it were, a single solid mass of the whole wall. This has been done by the invention of *mortar*. The basis of the compositions used for mortar is *lime*, a substance made by burning or calcining any of those earths which are called calcareous, or limestones. Of these it is the essential property to dissolve in acids. If, then, you were in an unknown country, and provided with a bottle of nitrous or muriatic acid (called aqua fortis, and spirit of salt), you might discover whether

whether

whether any stone or earth was fitted for making lime, by observing whether it effervesced strongly on pouring one of these acids upon it. The calcareous earths most commonly met with, are chalk, sea-shells, marble, and lime-stones of various colour and hardness, often composing whole rocks and quarries. Of these, the hardest in their natural state generally yield the strongest lime when burned. The process of burning is carried on in a kiln of a sort of conical form, with a fire-place at the bottom, and open at top. The calcareous earth, broken into pieces, is laid in layers alternately with the fuel, and a very strong fire is kept up during several hours. At the end, the earth is found to be converted into lime, which is effected by the dissipation of the water it contained, and also of a kind of air or gas, which the chemists have named carbonic acid. It is now of an acrid and caustic nature,

ture, and imbibes water with great rapidity, heating with it, and falling into fine powder. By the addition of water it is said to be *slaked*, in which state it remains cool, but is still deprived of its carbonic acid, which it does not recover till after a long exposure to the air. It is this fresh-slaked lime, mixed into a paste with sand and water, which forms mortar. The best sand for the purpose is the sharpest and coarsest; and the ingredients cannot be too thoroughly mixed. Good mortar will in time become as hard as stone itself; nay, in some very old buildings, the mortar has held a wall together after the stones or bricks were almost crumbled away. The manner of using mortar in building, is to imbed every single stone or brick in a layer of it, by spreading it with a trowel over the surface of the under ones, and between the sides of the contiguous ones, as the work advances. It hardens in proportion

portion as its moisture evaporates, and as the lime in it recovers its gas from the air.

Mortar is, however, employed not merely as a cement, but as a coating or covering to other materials. Thus, it is often spread on the outside or inside of walls, and upon the surface of ceilings. A mode of building formerly very common, and still in use, is to make a frame-work of timber with upright and cross beams, and to fill up the intervals with thin slips of wood called laths, which are then coated with mortar. When used for this purpose, it is mixed with chopt hair to make it adhere the better, and is called plaster. Such buildings are cheap, and neat to the eye, but are defective in warmth and durability.

As it is the quality of mortar to harden in time to a kind of stone, it
was

was an obvious thought to try how walls could be built of it alone. It seems as if this method had been occasionally practised by the ancients in constructing the high and massy walls of defence with which fortified towns were surrounded. At the present day there are parts of England in which small houses are very solidly formed of this material. The method is, to mix a quantity of sand with a proportion of quicklime smaller than that employed for common mortar, and with a little water; and then, having prepared a wooden case of the length and thickness of the proposed wall, to ram in this mixture very hard to the height of a few feet, and suffer it to stand in that state till quite firm and dry. The case is then lifted higher, and the same operation is repeated with fresh materials, till the wall is raised to the intended height. This

is

is not only a very substantial mode of building, but capable of being made to look very neat by polishing. So much for brick and mortar.

Adieu !

LETTER XVII.

ARTS OF SHELTER CONTINUED.

My dear Boy,

HAVING now made a sufficient provision of materials for any improvement in building that human art may suggest, I shall conclude my subject by a slight sketch of those successive steps in contrivance, which have advanced the simple hut or cottage to the comfortable dwelling-house, suited to the occasions of civilized life.

The utility of dividing the space enclosed within the walls into several apartments appropriated to different uses, would very soon become apparent. Of this degree of contrivance several quadrupeds have given an example, who, in their subterraneous habitations,

habitations, form distinct chambers for lodging in, and for repositories of their various stores of provisions. By means, therefore, of inside walls or partitions of boards, men would separate their sleeping-room, their cooking-room or kitchen, their store-room, and the like; and these they would fit up differently, making the bed-chamber warm and snug, perhaps with matting hung round it; the kitchen, well protected from the danger of fire; and leaving the store-room in a rough unfinished state. They would also soon discover the advantage of raising a floor to some height above the adjacent ground, and hardening it, either with beaten clay, or a pavement of stones or boards.

The great evil of a smoky house would soon put the inhabitant upon devising some better method of carrying off the smoke than through a mere hole in his roof. He would remove

his fire place from the middle of the room to one of the outside walls ; and having enclosed it at the sides with stone or brick, he would continue the structure up to the top of the house, forming it at a certain distance from the ground into a sort of tube or funnel, through which the smoke might be conveyed away clear from the building. Thus he would have an open fire-place below, for warming himself and cooking, terminating in a chimney above. This excellent invention, which contributes more than almost any other circumstance to the comfort of a house, would probably cost many trials before it was brought to perfection. There is reason, indeed, to believe that the ancients, even after they had acquired great skill in most parts of architecture, were little acquainted with the construction of chimneys, which would be most studied in the colder climates. In some of these, the stove is preferred

to the open fire for warming rooms. This consists of a kind of oven, heated from the outside, and projecting into a room, to which it communicates warmth through its body.

The admission of air and light would soon, even in the hut, be effected rather by aperture in the walls, than by the open door. These would be provided with shutters to close occasionally against the wind and rain, and during the night. But it might long exercise the invention how to contrive a method of lighting an apartment, while at the same time it was sheltered from the inclemencies of the weather. Some semi-transparent substance stretched over the window-frame would be thought of for this purpose; and we find that, in different countries, thin cloth, oiled paper, the fine membranes of the intestines of fishes, and other similar things, have been made use of. A kind of

transparent stone called *talc*, which divides in thin leaves, would be a still better material; but the difficulty of procuring it in large pieces, even in the few countries where it is found, would make its use in windows a great rarity. The manufacture of *glass* had been long invented before a method was discovered of forming it into flat plates. This discovery, however, could not fail of soon suggesting its employment for the purpose in question; and it is surprising to reflect how much pleasure and convenience was at once added to men's habitations by the adoption of glass windows. The solidity of glass renders it perfectly efficacious in excluding the fiercest shower or keenest wind; while its complete transparency allows the rays of light to pass with scarcely any obstruction. It was possible, therefore, by its means, to make the house at the same time lightsome and warm. The apertures
for

for windows were in consequence enlarged, and brought down to a level with the eye; and all the advantages of shelter were enjoyed, while the sight was gratified with the beauties of a fine country or a delicious garden.

As houses were enlarged in compass, it would be found necessary to give a new construction to the roof. Instead of a single slope, which would become too weak on account of the length of the rafters, a ridged or angular roof falling each way from the centre would be adopted. In making this, the front and back walls of the building being raised of equal height, a frame of rafters is sprung from the top of each, meeting a beam in the middle, to which they are strongly fastened. Other pieces of wood are nailed across, and thus a firm support is afforded to the material composing the covering of the house, while a rapid

fall towards each side procures a ready drainage to the water.

It would soon be considered, that the same roof being capable equally of covering buildings of any height, the readiest way of enlarging the habitable room in a house, would be to raise its walls so as to form one story above another. The art of making floors by letting timbers into the walls for their support, would then be discovered; as likewise the mode of communication by staircases. Another enlargement would be procured downwards by digging cellars, which would serve excellently for repositories of things requiring to be kept cool in summer and temperate in winter, as well as for stowing articles of cumbersome bulk.

In order to keep the house dry, and convey away what was offensive, drains running under ground and communicating

cating with some main channel would be found expedient. These conveniences were thought of so early, that in the very infancy of the city of Rome, its drains or sewers were a work of vast labour and contrivance, and excited the admiration of posterity. The disagreeable dripping from the eaves of the roof in wet weather would suggest the contrivance of troughs and spouts to carry off the rain-water, and either deposit it in reservoirs, or convey it to the drains.

Out-buildings adjoining the dwelling, for washing, baking, and other household purposes, and for the lodging of domestic animals, would be found very convenient, and would be erected wherever the space permitted. With these would be connected a paved and enclosed yard, furnished with a supply of fresh water by means of a well,—or a pump, when that machine was invented. Thus every opportunity would

would be given to promote *cleanliness* of the person and abode; which is certainly one of the principal comforts of civilized life, and one of its chief distinctions from the savage.

The preceding enumeration of successive improvements in the building art, which is drawn from reality, affords a pleasing instance of the progress of human skill in the exertion of the powers kindly bestowed upon man for bettering his situation. Every encouragement, indeed, has been given to the exercise of *industry*, that great principle, which the poet Thomson has so well represented as the author of all that makes existence desirable.—

Industry

pointed out
Where lavish Nature the directing hand
Of Art demanded; shew'd him how to raise
His feeble force by the mechanic powers,
To dig the mineral from the vaulted earth,
On what to turn the piercing rage of fire,
On what the torrent and the gather'd blast;

Gave

Gaye the tall ancient forest to his axe ;
Taught him to chip the wood and hew the stone,
Till by degrees the finish'd fabric rose.

Thomson's Autumn.

Having now provided you with
wholesome food, warm cloathing, and
a good house over your head, I think
I may decently take my leave ; so,
my dear boy, farewell, and make the
best use of the humble but well-meant
instructions of

Your truly affectionate friend.

THE END.

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