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PREFACE.

This volume has been constructed on the presumption that those who may use it can already read fluently and intelligently.

The Editor's purpose has been not to give formal courses of instruction in various departments, but to afford the means of *cultivating* the opening mind of youth, and, at the same time, to give a certain completeness and firmness to previous acquirements, by introducing, in a new and fresh form, the subjects partially handled in the earlier lesson-books of the Series. The treatment is designedly free from technicalities, in so far as it is scientific; sacrificing to attractive method and style all attempt at exhaustiveness, and even at instructiveness, in the more pedantic sense. The object is to interest boys and girls in all those subjects which form the staple of the mental life of an educated man, by speaking to them on what may be regarded as representative[1] departments of knowledge in a way which is suitable to their years, and likely to promote a taste for intellectual pursuits.

The only subjects which have been treated technically are Human Physiology and Botany, and this for two reasons—(1.) Because it is difficult to advance beyond the vaguest and most elementary statements in these departments of science, without adopting technical language and treatment. (2.) Because at

[1] The Sciences of Observation, Experiment, and of Organic as well as of Inorganic Nature, are represented in Natural History, Physics, Human Physiology, and Botany, which severally deal with the Animal, Vegetable, and Mineral world. The Useful Arts or Technology, is represented by the lessons of Professor Archer. The Moral Sciences find practical illustration in the Social Economy and the lessons on Law and the Constitution, while they also occupy a large share of that portion of the book devoted to the æsthetic cultivation of the pupil—the Literary Selections.

the age to which advanced classes have attained, it is desirable that, while Literature and Social Economy are a common ground for all, some one department of science should be taught *as a discipline*, and, therefore, with the strict use of precise and technical terms. With this view Human Physiology and Botany have been selected as offering a suitable alternative to different classes of teachers and pupils.

As in the Scientific, so in the Literary Lessons, the Editor has endeavoured not to over-estimate the capacity of *intelligent* pupils. But the necessity of introducing *interesting* reading has not been allowed to exclude those passages from our Classics which offer to the Teacher a valuable means of conveying instruction or developing taste.

The lessons on Law and the Constitution and the Literary Extracts, have been compiled by the Editor, and are intended to be read *along with* the scientific chapters: the other subjects have been handled by men each distinguished in his own department, viz., Professor Tyndall of London, Professor Kelland of Edinburgh, Professor Archer of Liverpool, Mr. Patterson of Belfast, Dr. Struthers of Edinburgh, Professor Balfour of Edinburgh, and Mr. Shields of the Birkbeck School, Peckham. These names are a sufficient guarantee to every teacher.

The Publisher has to thank Messrs. J. W. Parker and Son, and Messrs. W. Blackwood and Sons, for permission to reprint extracts from Works published by them, viz., Mr. Kingsley's VILLAGE SERMONS, *and Mr. Caird's* RELIGION IN COMMON LIFE.

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LESSONS IN NATURAL HISTORY.

LIFE AT THE SEA-SIDE.

"Come unto these yellow sands."

A GLANCE at a map of the British islands will show that they are indented with numerous bays, lochs, or firths, differing greatly in size and form. Nor do they differ less in the degree to which they are exposed to ocean storms and currents, the temperature and depth of their waters, the proportion of fresh and sea water that they contain, and in the geological structure of the sea-bottom, and of the adjacent shores. All these circumstances exert an influence on both animal and vegetable life. Changes in the marine vegetation are attended with changes in the species of animals that depend on that vegetation for support. And the fact of a sea-bottom being sandy or gravelly, oozy or rocky, renders it fit or unfit for the residence of whole tribes of creatures that live on others more minute, and are in turn preyed on by species more powerful than themselves.

To know with accuracy the various kinds of animals found as permanent residents or occasional visitants in any one of those bays, would demand the careful and untiring observations of many years, and would require an amount of knowledge that comparatively few possess, and an expenditure of time that not many mortals in this "work-day world" have at their disposal. But to note the species that are most common, with the times of their appearance when they are not permanently present, and the circumstances under which they live, is not difficult; and this all might do to a greater or less extent. Such labour would be highly instructive and interesting. It would train the mind to habits of accurate observation, patient research, comparison, and generalization. It would be an efficient promoter of bodily health, by giving an inducement to active exercise out of doors; requiring the use of the gun and the net, the spade and the fishing-line, the dredge and the towing-net; and at the same time habituating the observer to habits of hardy endurance and of self-reliance.[1]

Before bringing under the notice of the reader some of the most common animals to be met with at the sea-side, it may be well to mention that all animals have been arranged in four great groups or sub-kingdoms. These divisions are founded not on external form only, but on internal structure, and especially on well-marked modifications of the nervous system. These groups are—

1st, Vertebrata—Animals having a skull and back-bone or vertebral column, such as man and quadrupeds, birds, reptiles, and fishes.

Next follow those which are destitute of the skull and back-bone, and from this circumstance are termed Invertebrate. They consist of—

2d, Mollusca—Soft-bodied animals, such as the cuttle-fish, the snail, and the oyster.
3d, Articulata—Jointed animals, such as spiders, insects, crabs, and worms.
4th, Radiata—Rayed animals, such as star-fishes, sea-jellies, and zoophytes.

In the brief notice which can here be given of any of these animals, I shall begin with birds. I do so, because of the beauty of their forms, the variety of their plumage, the grace of their movements, and the animation they impart to both inland and maritime scenery. Instead of marshalling these according to their families and orders, let me introduce them in a more general way, by means of an address delivered at Holywood to an audience consisting of boys and girls.

[1] Those records of animal life possess a great interest for the zoologist. They have a two-fold value: they enable the man of science to compare the list of one locality with that of another, and thus supply material for tracing the laws that regulate the diffusion of animal life; and next they place in the hands of the inhabitants of that district the means of observing what changes have taken place in the species of animals which it contained. Such changes are more frequent and more numerous than those who have not attended to the subject would probably suppose.

BIRDS.

THE STRUCTURE AND FOOD OF BIRDS.

"Some sought their food among the finny shoals,
Swift darting from the clouds, emerging soon
With slender captives glittering in their beaks;
These in recesses of deep crags constructed
Their eyries inaccessible, and trained
Their hardy brood to forage in all weathers."—MONTGOMERY.

WE are all fond of birds. We like to mark the sea-gull sitting tranquilly upon the wave that rises and falls beneath. We like to see the sparrow hopping about our doors, and the swallow sweeping in graceful circles to her nest under the eaves of our houses; and we all love to listen to the song of the lark, when, like a speck in the sky, he pours a flood of melody down upon the earth.

Birds are very wonderful creatures; but because we see them daily about us we are apt not to think them so. If they were not thus common the case would be very different. Let us suppose that none of us had ever seen a bird, and that a traveller, who had been in distant countries, came home and told us that he had there met with animals that did not swim through the waters like fishes, nor walk on the earth like dogs or horses, but went far higher into the air than a boy's kite, and could move through it at the rate of forty, or sixty, or perhaps, a hundred miles in the hour. How surprised we should all be at this wonderful story! And if we believed that the traveller was telling us the truth, how eagerly would we listen to the description of animals that, instead of being clothed with scales like a fish, or hair like a cow, had the body covered with feathers; and instead of having two fore-legs, like those of our common animals, had the limbs of the fore-part of the body of a different shape, and so contrived, that by their movements the creature was not only sustained in the air, but propelled rapidly forward!

If the boys and girls who read this had heard these wonderful facts for the first time, and were talking to each other about these strange unknown animals, all would infer that they must be differently formed from beasts or fishes, and would try to imagine how they were made. Perhaps one might say,—"Their bones must be very strong, for unless they were so, they could not take such long flights." But another might say,—"No; if their bones were very strong, they would be very heavy, and then the bird would not be able to fly at all; the bones, I think, should be very light." Another, who was a little more advanced, might say,—"It would not be enough that they should be both strong and light at the same time, if that be possible, but the cords or muscles, by which the bones are moved, must be so made as to work with vigour and effect." But then a fourth might exclaim,—"All this would not be sufficient; if I run for a quarter of a mile I am out of breath; how are birds so long-winded, that they can go at so great a rate and for so long a time?"

These several points of inquiry can only be answered by the actual examination of the body. It will then be found that the bones do combine the two opposite qualities of lightness and strength. They do so, not only because of the material of which they are composed, but also because of the manner in which they are severally shaped and united together. The muscles, also, will be found to be so formed and so placed that they act with the greatest possible advantage; and with regard to the breathing, an arrangement is made adapted expressly to the wants and habits of birds, and peculiar to them. The air from the wind-pipe passes not only into the lungs, but from them into cavities or air-cells, situated in different parts of the body. The blood is thus more freely exposed to the air than it is in other warm-blooded animals; the body is rendered more light and buoyant, and increased vigour is given to every part of the frame. The air penetrates even into the bones, so that in birds of rapid or powerful flight, the hollow part in the centre of the bone is filled, not with marrow, but with air. If an architect, accustomed, in planning his buildings, to calculate in what way he could shape his timbers so as to combine the greatest lightness with the greatest strength, were to examine the framework of the bones of a bird, he would find all his contrivances there surpassed. If a mechanic were to plan how best the bones might be shaped for certain purposes, and how they could best be moved, he would find his most skilful devices fall far short of the mechanism there exhibited.

You all know that the bodies of birds are warm. Their blood is not cold, like that of a frog or a fish; it is not only warm, but is found, in consequence of the way they breathe, to be warmer than that which is in our bodies, or in those of our common domestic animals. This heat would soon pass away from birds as they fly through the air or swim in the water, unless their bodies had some kind of covering to enable them to retain it. A covering has, therefore, been provided for them, which is, at the same time, light and warm. It is, as you well know, formed of feathers; those next the body being shorter and finer, those outside larger, stronger, and tinted with a splendid variety of colours. But this feathery garment would soon be spoiled were no means taken to preserve it: the sun, and the wind, and the rain, would all do it injury, though in different ways. That it may be kept in perfection, it is not only renewed from time to time, but each bird is furnished with a gland, which secretes an oily material fit for the preservation of the feathers. You have seen birds arranging their tost plumage, cleansing off all impurities, smearing the feathers with this oil, and, as you would say, "preening" themselves. You know that if your hands have touched oil or butter, the oiled parts cannot be wet; the oil causes the water to fall off. Now, in those birds that live much upon the water, the oil is very abundant. They smear their feathers with it, the water is repelled, it does not reach their skin, and thus the heat of their bodies is kept up, even when they are for hours in the water.

Now, let me suppose I had a very large net—a net like that which you see the fishermen using, but so large that it would extend over a space of two miles on every side—and that I caught at one time all the birds both on sea and land, which the net covered, and brought them here together. Suppose I could collect all the boys and girls who lived in that area, and bring them also here at the same time. If I were then to tell them the different kinds of food these several birds required, I might say to one group of children, "These birds, though differing in size, plumage, and shape of bills, live principally upon fish; I put them under your care: give them their proper food." I might say to others, "These birds feed upon small insects, which live under the bark of trees: you will supply them." To others I might say, "These birds with the strong hooked beaks feed upon other birds, and small animals: I put them under your care." Again, I might desire an assemblage of girls to furnish the seeds, the grains, the worms, and the caterpillars, which form the sustenance of birds of a different kind; or I might place under the charge of a number of boys the members of another family, such as the vulture, whose food should be flesh, and, perhaps, that flesh a little putrid. Suppose you were to exert yourselves ever so much, do you think that you could supply all these several birds with their respective food for a single week? I much doubt if you could; and I am quite sure you would not have all the birds alive at the end of a month. Some would, perhaps, have died from being over-fed, and others of starvation. Yet as it is, week after week, and month after month, all these birds find out for themselves their proper food. We are not aware of the amount of individual exertion it requires. The labour of procuring the food is not obvious. We have to think about it before we rightly estimate its extent. And then we naturally ask ourselves, "How are these irrational creatures so wonderfully provided for?" There is but one answer, *God feeds them.* He teaches to each what is its proper food, and by what means it may be procured; and thus most truly and emphatically may it be said, *God feeds them.* With this idea many of you are already familiar; for you have read in your Bibles, "Behold the fowls of the air, for they sow not, neither do they reap, nor gather into barns; yet your heavenly Father *feedeth them.*"

The Heron.

None of the birds that frequent the sea-shore are objects of so much attention as the heron (*Ardea cinererea*). Every passer-by takes notice of its watchful attitudes, as, standing at the water's edge, it gazes at the flowing tide, or by the margin of one of the little pools upon the shore, waits for its prey, or stealthily approaches its victim. It is most frequently seen near that part of the bay where the banks are oozy, and covered with grass-wrack (*Zostera marina*). These banks form the sea-meadows, or pasture-grounds of hosts of minute shell-fish and other molluscs; these, again, are preyed upon by fishes of different kinds, and hence these banks form the favourite feeding "ground" of the heron. His fish-dinner can there have its accompaniments of crustacea and mollusca in a state of perfection and freshness that an alderman might envy.

Standing singly, or in little groups, along the sea-margin, these birds will remain, as if unconscious of external objects, while the railway trains dash past them laden with passengers. A conviction that the rushing train brought no danger to them seems to have been very quickly arrived at.

Occasionally the heron may be seen in a very different situation. There is an extensive wood of dark-foliaged pine and silver fir, mingled with other trees, which crest the upper portion of a high hill within a few minutes' walk of my present residence. This is a favourite resort of the heron. Often have I been struck with the strange appearance of these bulky birds on those trees, where sometimes they assemble in little groups of half a dozen or even more, and I have looked with admiration on the light and peculiar tints of their plumage, contrasted with the foliage.

It is worthy of note that herons appear to be more sociable than is generally supposed. The following particulars respecting them have been published by a most accurate observer.[1]

On the Antrim side of the Bay of Belfast, the herons seldom perch on trees, apparently never, through choice, by day. They "betake themselves singly, or often in little parties of three or four, to the demesnes bordering the estuary, until, in some particular spot, from twenty to perhaps fifty are congregated together. Here they remain in the centre of large pasture-fields or meadows, out of the reach of gun-shot from any fences, until the tide has sufficiently ebbed. A flock of these gigantic birds appears very beautiful when coming silently in view over the banks of fine lofty trees, as I have seen twenty do in a compact body, and not only continue thus in flight, but alight together on the beach."

On one occasion (Nov. 1847), forty-two herons were reckoned in a ploughed field from which the sea is not visible. They appeared to great advantage, from their colours contrasting finely with the rich brown hue of the upturned soil. They were mostly at rest, with the necks drawn in, and the plumage puffed out, so as to be apparently of huge bulk. On a sun-bright lovely day of November in a different year, the same author, describing the birds observed during a three-mile walk

[1] Thompson's *Natural History of Ireland*, vol. ii. p. 134.

along the shore of the bay, says,—"The sea-gulls in their snowy garb, were, as usual, highly attractive; but the herons bore off the palm from all the others. After having been driven from the banks by a high tide, they were returning now that it had ebbed; and the whole expanse of sky before me was enlivened by their presence. At one view I reckoned fifty spread singly over the atmosphere. The many-coloured sky, chiefly blue, with white and rich yellow clouds, against which they were seen, much enhanced their appearance. I have occasionally, though not to-day, remarked the white portion of the herons' plumage to look beautifully roseate, with the rich tints of the setting sun upon it."

Such a flight, observed with the eye of the naturalist and the artist, is well deserving of record. But the eye of the sportsman in former times looked upon a flight of a different kind, when, in the days of falconry, a pair of hawks were flown at a single heron. Such a scene, Sir Walter Scott has described with so much animation, that he almost makes us spectators of its exciting details:—

"Eager as a frigate in chase of some rich galleon, darted the falcon towards the enemy, which she had been taught to pursue; while preparing for defence, if he should be unable to escape by flight, the heron exerted all his powers of speed to escape from an enemy so formidable. Plying his almost unequalled strength of wing, he ascended higher and higher in the air, by short gyrations, that the hawk might gain no vantage ground for pouncing at him; while his spiked beak, at the extremity of so long a neck as enabled him to strike an object at a yard's distance in every direction, possessed, for any less spirited assailant, all the terrors of a Moorish javelin.

"Another hawk was now thrown off, and encouraged by the halloos of the falconer to join her companion. Both kept mounting or scaling the air, as it were, by a succession of small circles, endeavouring to gain that superior height, which the heron on his part was bent to preserve; and to the exquisite delight of the spectators, the contest was continued until all three were wellnigh mingled with the fleecy clouds, from which was occasionally heard the harsh and plaintive cry of the quarry, appealing, as it were, to the heaven which he was approaching, against the wanton cruelty of those by whom he was persecuted." [1]

[1] *The Betrothed.*

The Dunlin.

The heron is one of the wading-birds. To the same group belongs the Dunlin or Purre (*Tringa variabilis*), the smallest and the most abundant of all the sand-pipers. But though in itself a very pigmy representative of the order, it makes up in numbers what it wants in size, and vast flocks of them may be seen along the edge of the sea, searching for worms, crustacea, and mollusca. "If disturbed," says Mr. Yarrell, "the whole flock take wing together, and wheeling along in half circles, near the edge or the surface of the water, each bird exhibits alternately a dark or a light appearance to the observer, as the upper or the under side of its body happens to be turned towards him." The change of appearance thus adverted to, is the circumstance which strikes the observer with surprise. One moment a flock of perhaps one thousand birds is shining before you, as if arrayed in silver; the next moment, they are shrouded in gloom, as if every individual had arrayed himself in the cloak of darkness, described in the fairy tale. When I add, that at times every bird gives forth a pleasant note, making the whole strand musical, the reader will see sufficient reason for looking with interest on those feathered multitudes, that by voice and motion indicate the happiness with which they have been gifted.

The following remarks will show how they have been regarded by other eyes than mine, and that winter does not stop their aërial gambols, though summer is the time at which they have come under my own observation. *December* 1, 1836.—"I observed for a long time a great flock on wing, consisting of not less than two thousand birds; this body, as usual, divided into two or three flocks, which alighted separately, but soon again, without being molested, rose into the air, when all again joined and went through the most graceful and beautiful evolutions. When immense flocks divide, fly right and left, and shoot into single strings, they strike upon the eye, while the sun shines upon them, the dark banks of the bay serving as background, like silver lines, occasionally of great length. A flock flying for a great distance, just above the margin of the flowing tide, strongly resemble, from their white plumage being displayed, a single wave sweeping rapidly onwards."

"On another occasion, Dec. 1840, I saw more dunlins together than I had ever before observed in so small a space. There could not have been less than five thousand; as many as three thousand were in a dense flock, busily feeding, and keeping up a thrilling concert, like grey linnets when congregated previous to roosting; the others were somewhat more scattered. A few days afterwards, a friend being out shooting, early in the morning, on the Down shore of the bay, saw a flock of several thousands. He described their appearance, as the sun rose, to have been one of the most beautiful sights he ever witnessed. The great body first appeared glancing in the sun; then it broke up into a dozen flocks, which rose and fell in the air like molten silver, or, as his companion observed, like showers of new shillings—a most apt image! One of the finest effects is when the background is so dark that the birds are only seen in silvery whiteness, flashing their under-plumage upon us." [1]

There is another bird belonging to the same order, on which I would gladly dwell,—the Curlew, the most wary and quick-sighted ot all our shore birds, remarkable both for its peculiar cry and for the wedge-shaped form that the flock assumes when on the wing; but space forbids, and I pass on to that family of birds with which the most casual visitor to the coast is familiar—the sea-gulls.

Sea-Gulls.

Black-headed, Herring, and Black-backed Gulls.

Several species frequent the bay of Holywood; but the one known as the Common Gull (*Larus canus*) is not in this locality the species which is most abundant. That designation might be more properly claimed by the Black-headed Gull (*L. ridibundus*); so that we have here one example of the facility with which we may be deceived by names, if they alone were considered. It is in appearance a very attractive bird; white, grey, and black, mingle most harmoniously in its colouring; the breast, the under surface of the body, and the tail feathers, are of the purest white; while the beak, the legs, and the feet, are of vermilion red. Hence the term "Red-legged gull" is not less correct than that of "Black-headed."

Unlike most of its brethren, it sometimes selects inland loca-

[1] Thomson's *Natural History of Ireland*, vol. ii.

lities for its breeding haunts, as Staffordshire and Norfolk in England, and islands in Lough Neagh and elsewhere, in Ireland. But its visits to the interior of the country are not limited to the period of incubation. They spread themselves in large flocks over the country, especially when the farm labour is going on, and follow the plough as regularly as rooks. From the quantity of worms and grubs which they thus destroy, the farmer should rank them among his most active friends. No regularly-paid farm labourers would be half so efficient. This habit is not confined to the present species. Its proper feeding ground, however, like that of all its tribe, must be considered to be the sea itself, and the adjacent shore. The food consists of small surface-swimming fishes, the fry of fish, the soft-bodied animals that live on the green oozy banks where the grass-wrack grows, and the minute creatures that the tide flings upon the beach. So numerous are the black-headed gulls in the vicinity of Holywood (Belfast), that so many as two hundred have been noticed feeding together on the beach, and quietly keeping pace with the receding tide. To look at them at such a time, and see their enjoyment of the food thus bountifully provided for them, we might well remark, "How happy do they appear!" Yet not less, but, if possible, more happy do they seem, when a flock of fifty or more goes through its graceful evolutions in the air, sailing round and round, or flying in all possible directions within the circumference of a limited circle. No sound is uttered by them at such times; the easy movement and the companionship of their fellows would seem to constitute perfect enjoyment. All such feelings we can but imperfectly understand; but such a spectacle enables us to appreciate more fully the description of the poet—

> "In plumage delicate and beautiful."
> "With wings that might have had a soul within them,
> They bore their owners with such sweet enchantment."

When passing along the shores of the bay, little groups of sea-gulls may often be observed scattered near the sea-margin. At first sight you are not sure whether you are looking at birds or at masses of the sea-foam. Often at such times I have wondered "can they be pondering on state affairs?" and wished that, like the vizier of the Sultan in the Eastern tale, I understood the language of birds. Those sociable little groups are not formed of one species only, but of three or four. Our two largest species of gulls may be seen with them or beside them, and never at such times appear in any way to molest their weaker relatives. They are all on their good behaviour.

Let me change the scene, and depict the two larger gulls in their ordinary way of life; and first, the HERRING GULL (*Larus argentatus*), a species particularly daring in approaching the boats and nets of fishermen. Whenever a shoal of fish suitable for prey is discovered, we may be sure that this gull takes part in the foray. The scene at such times is highly exciting. One popular writer describing it says,—"We were bearing down to a glorious play of sea-birds, and I got a gun uncased to practise at the gulls. It was a curious and bustling scene. Above, thousands of these birds were congregated in a small circle, screaming, and rising, and dipping over a dense mass of fry, which appeared at times breaking the surface of the water. . . . The great body of sea-fowl appeared so much engrossed with their predatory pursuits, as neither to attend to the report of the gun, nor notice the approach of the hooker, until the boat's bowsprit seemed almost parting the countless host of floating and flying plunderers. . . . I fired; a solitary gull dropped in the water, and half a dozen wounded birds separated from the crowd, and went screaming off to sea." On the sufferings of the wounded birds the eloquent writer does not waste a thought. He wanted "to practise" at the gulls, and he did so. When shall we learn to use with more consideration the powers with which we have been invested over the lower animals?

At other times, the Herring-gull preys on fish taken in nets, on the soft-bodied sea-animals, and shell-fish of the shore, and occasionally a fragment of carrion does not come amiss. At the promontory of Horn Head, in Donegal, where fish are abundant, this gull is so much of an epicure as to prefer the flesh of the young rabbits from the adjacent warren; and so destructive is it considered, that the proprietor of the warren gives a reward of fourpence for the head of every herring-gull brought to him.[1]

This species, as well as the great Black-backed Gull (*Larus marinus*), will occasionally bear down on a flock of widgeon, which will immediately take flight in great alarm, even when swimming in company to the number of a thousand or more. The latter gull has been seen to strike down a widgeon from the flock, and

[1] *Vide* Thompson's *Natural History of Ireland.*

seize it as his prey. A sportsman holds these gulls in abhorrence, for so great are their powers of flight, that they will dart down on wounded birds, and destroy them before his very eyes. The great black-backed and herring-gulls will sometimes also pursue individuals of their own species, to make them deliver up choice food, too large to be immediately swallowed. They occasionally give each other severe chases, each trying to be uppermost. If the first drop the food, this is picked up by the second, which in its turn becomes the pursued.[1] To the Black-backed gull, the offal of the beach, the body of a dead pig, or the carcase of a dead horse, furnishes an acceptable banquet. The herring-gull, the carrion crow, the grey crow, and the raven, have been seen sociably to partake of the same repast. Dogs would occasionally present themselves, and, without formality, take a share of the feast; but at such times the two large gulls would walk off to a little distance, in a manner that evinced their displeasure at the intrusion. They would never condescend to eat in the society of dogs!

The great breeding-haunt of gulls in my neighbourhood (Belfast) is a ledge of basaltic rocks, about two hundred feet in height, a few miles to the north of our bay. In 1849, it was estimated that so many as a thousand pair of Herring-gulls had their nests there. So also had guillemots, puffins, jack-daws, and hooded crows. The rock-pigeon and the green cormorant build in its caves. The peregrine falcon and the kestrel hawk there construct their eyries, and under the ledges of the rocks the house-martin suspends its "pendant nest and procreant cradle." The cliffs, bare and bleak as they are at other times, are then decorated with luxuriant tufts of the sea-pink, and other wild-flowers that love to nestle on the ledges and in the fissures of the precipice. It seems as if the sternest scene assumed a graceful and varied costume, in honour of the gentle cares of its feathered visitants during the period of incubation. The whole range of cliffs at that time is animated with bird-life, and musical with their varied notes. If a gun be fired, hundreds of birds dart into the air, uttering screams of terror; these soon subside, and we again hear only the

[1] *Vide* Thompson, *Nat. Hist. of Ireland.* I am glad to have had the opportunity of introducing into a book intended for schools, some passages from the publications of my lamented friend, the late William Thompson, Esq. He had himself hoped to have made them available for the instruction of the young.

modulated cries and notes, which reach the ear softened by distance, and blend harmoniously with the sound of the waves as they break upon the base of the precipice. When last I visited the spot, several very young birds—the broods of herring-gulls—were swimming fearlessly about, imparting an additional charm to the scene.

Birds, like quadrupeds and man himself, belong to the group of animals termed *Vertebrata.* They are so named from their having a skull and back-bone or *vertebral* column.

SHELLS, AND THEIR BUILDERS.

> . . . . . . "I have seen
> A curious child applying to his ear
> The convolutions of a smooth-lipped shell
> To which in silence hushed, his very soul
> Listened intensely, and his countenance soon
> Brightened with joy; for murmuring from within
> Were heard sonorous cadences, whereby,
> To his belief, the monitor express'd
> Mysterious union with its native sea."—WORDSWORTH.

How very pleasant it is to stroll along the beach, and feel the refreshing sea-breeze on your cheek, and the sound of the ripple in your ears! One afternoon I was obliged to forego this gratification, for a strong inblowing gale, which had continued during the entire day, was still unabated. Next evening, however, I walked along the shore with a group of merry children, picking up the shells, zoophytes,[1] and sea-weeds, which the waves had cast upon the strand. Among them were some soft yellowish masses, varying from the size of a child's hand to that of a child's head. Each was composed of a number of regular shaped cells, which at a little distance reminded one of an empty honeycomb, or of the interior of a wasp's nest. Yet a second glance showed that there was no real likeness either in shape or in material. The cells of the bee and of the wasp are hexagonal, those were somewhat roundish in outline, but flat at one side and convex at the other. The bee forms her cells of wax secreted between the rings of her body;

[1] Marine productions belonging to the animal kingdom, but, in many cases, having the aspect of vegetables.

the wasp forms hers of a kind of paper made from vegetable fibres collected by her for the purpose ;—but these sea-born cells were membranous and tough. By what creature were they fashioned? For what use were they intended? They were deposited by the whelk or "buckie;" they had contained the young, and the hole was visible in each through which they had escaped. It was strange to think that each of these little capsules had been the nursery in which some four or five young "buckies" had passed their infancy, and from which they had gone forth into the world of waters around. It may be mentioned, as one of the countless examples of Providential care, that at this period of life, when we would suppose them to be most helpless, they are furnished with organs by which they can swim freely about—a power which, as you all know, they do not possess when more mature.

1. The Whelk.—My little party soon picked up two or three empty shells of the whelk, showing the appearance it presented at successive ages; and ere long a shell of full size was found near low-water mark, with its owner in full activity and vigour. We could see that the shell had been enlarged from time to time to suit the increasing bulk of its inmate; and he must, of course, have acted as his own architect and builder, for such dwellings are never "built by contract," and never change in fashion. On this point my little companions inquired no further. They sought not to know *how* the shelly matter was secreted, or by what organ it was deposited. What *use* was made of the whelk was a subject in which they took a more lively interest; and they added queries about where and how it was taken. The replies were much to the following purport.

"The common whelk is universally distributed around the British shores, varying greatly in its characters, however, according to locality. It is collected and taken in lobster-creels or baskets, for bait or food; great numbers are constantly exposed for sale in London, simply boiled, to be eaten with a little vinegar and pepper; a poor man's delicacy, but by no means a wholesome morsel." [1] It was not always, however, a dainty dish for the poor man only, but appeared at banquets of the rich and powerful. Thus we are told by Dr. Johnston, that at the enthronization feast

[1] *Hist. of British Mollusca.* Van Voorst.

of William Warham, Archbishop of Canterbury, in 1504, no fewer than eight thousand whelks were supplied at five shillings for a thousand. The great extent to which the whelk is used in some places for bait, may be judged of by the fact stated by a late well-known naturalist, James Wilson, Esq., of Edinburgh. At Portpatrick, it is caught for this purpose in baskets, "containing pieces of fish, which are let down in about ten fathoms' water, about a quarter of a mile off the harbour or the old castle, and are drawn up daily to be emptied of the shell-fish which have crept into them to feed on the dead fish. Each shell serves to bait two hooks, so that, reckoning the number of hooks used by all the boats at 4500, about 2250 of these large shell-fish must be destroyed every time the lines are shot, and probably not fewer than 70,000 every year. Yet the supply, chiefly obtained from a space of no great extent, seems to be even more abundant than ever."

While the whelk is directly and indirectly the means of giving a supply of food to man, let us see how he gains his own livelihood. To him any kind of decaying animal body furnishes a feast. We have seen how his eagerness to prey on the dead fish lures him to his destruction. But this is not his only way of "making a living." More fortunate than many other epicures, he has "two strings to his bow." When such odoriferous viands as those with which the basket is baited, are not to be had, or he chooses to have a change of diet, he turns with cannibal eyes to some of his molluscan brethren. But how is he to get at the fleshy body which is protected by a shell in some cases as strong as his own? To starve the garrison into surrender is impossible; how can it be taken by assault? The weapon employed is of a peculiar kind, but most effectual; it is a flexible proboscis enclosing a tongue! This tongue is armed with a hundred rows of formidable silicious teeth. Unlike the clumsy instruments made by human hands, it can do the work of distinct tools; it can serve for an auger, or it can be used as a file. Thus armed, the whelk breaks through the shell of his victim, and secures his prey. He is, of course, a carnivorous or flesh-eating animal.

2. The Limpet.—The common limpet, on the contrary, is a vegetable feeder; his pastures are the growing sea-weeds of the rock on which he rests. As he is not gifted, however, with the complex stomachs of the ruminating animals, he requires some

simple apparatus to rasp down the sea-weed, and render it fit for digestion. And this he has in a tongue, which is nearly twice as long as his body, and furnished with a formidable array of horny-looking teeth, most of them curved, and well adapted for acting on the sea-weed.

Children of all ages like to put everything they can to the test of more than one of the senses if possible. It was natural, therefore, that my vivacious body-guard should not rest satisfied with being told about these tongues, but should desire to see that both the whelk and the limpet had really tongues; and also, that the teeth, which had such different functions to perform, showed a corresponding difference in number, form, and arrangement. Accordingly, we secured two whelks and two limpets, and carried them home for examination under the microscope.

When "set up" on a glass slide in the usual way, with a little Canada balsam, the tongues of these molluscs, and of others belonging to the same class, are very beautiful and interesting objects. The most careless observer cannot but be struck with their beauty and diversity; with their perfection, which attests the hand of the Divine Creator; and with the abundance of teeth, as evincing his providential care for every one of his creatures, however lowly.[1]

These lingual teeth are formed of flint, and are indestructible in acid. In general, they are amber-coloured or glassy, but some are not so. Their shape is greatly modified in the several groups. Sometimes they bear a resemblance to the bill-hook with which the farmer trims his hedges, the sickle with which he reaps his corn, or the scythe with which he mows his meadows. Others remind one of mathematical figures, such as the parallelogram; and some can only be compared to hooks or to saws. But so great is the diversity, that instead of any of these figures, we sometimes see only a series of symmetrical and interlacing curves.

[1] The pleasure my own family took in examining the tongue of the limpet induced me to show it to the children of a school; but as only one could see it at one time, I made a coarse drawing of it, on a large scale, so that all the children might see it at once. Great was the interest it excited; and it convinced me that few lectures would be more useful than those which would communicate to children round our coast, in clear and simple language, some elementary knowledge of the common sea-side objects that they meet with every day. Such lectures should be short—fifteen or twenty minutes would be sufficient—and one thing only should be taught in each. Those who have never spoken to children on such subjects can scarcely imagine how eagerly such information is received; nor how bright and happy is then the circle of little faces.

That part of the tongue of the limpet near the point is, of course, subjected to an amount of wear and tear very different from the other portion. With constant use, teeth, even of flint, must in time wear out. A constant succession of them is, however, most bountifully provided; and there is a continued growth of the tongue at the back part to counterbalance the wear that is going on in front. This reserve part is folded up beneath the viscera of the limpet. When the fore part of the tongue, where alone the teeth have their requisite degree of hardness, is worn down, the part supporting them disappears likewise, and the adjoining part comes into play. The entire number of rows of teeth is about 160, and as there are twelve teeth in each row, the limpet has in all about 1920 teeth.

But this supply, liberal as it is, falls short of that possessed by his air-breathing brethren that live on land. The large black slug (*Arion ater*) has 160 rows of 110 teeth, making a total of 17,600; and this is exceeded by the large grey slug (*Limax maximus*), who enjoys 160 rows of 180 teeth, making an aggregate of 28,800 teeth! The hedge snail, with its pretty little banded shell and variety of colouring, has 135 rows of teeth of 100 in each, making 13,500 in all. What wonder that the farmer and the gardener should occasionally bemoan the injury sustained by their crops from assailants so formidably armed!

Now, all those creatures, whether on land or sea, agree in this—the body is covered by a skin which is soft and moist; this softness of the skin is one of the characteristics of that division of the animal kingdom to which they belong—the *mollusca*. Again, while the oyster and the mussel have shells consisting of two valves or pieces, others, like the whelk or the snail, have the shell of one piece only; hence the latter are spoken of as *univalves*, and the former as *bivalves*. The whelk and the snail agree in another point—they move by a large expanded disk or "foot," placed at the lower surface of the body. From this peculiarity, all animals in which it is manifested are placed in one group, and receive a scientific name (*Gasteropoda*), which literally means "belly-footed." This large *class* of molluscs is again divided into *orders*, according to modifications of the breathing organs.

3. The Boring Cockle, and the Mussel.—Let us return once more to the shore. About a mile from my house there are ledges of hardened clay, which are covered by every tide.

They are pierced with holes, the borer being one of those bivalve shells, to which children give the name of "Lady cockle," and the learned that of *Tapes pullastra.* A few specimens are carefully dug out, alive and uninjured, are carried home, and placed in a deep plate filled with sea-water. While I am transferring them, the children, by my directions, tear up an old envelope into small fragments. That being done, I take the paper and sprinkle it over the surface of the water. In one moment all the pieces are in motion—one hurrying here, another there, stopping suddenly as though they had forgotten something, then hasting forward with increased speed. They are dancing! hands across, set to partners and turn, down the middle and back! Are the bits of paper bewitched? The children are clamorous with delight, and ask the cause of it all. The explanation is not difficult. Those "shell-fish" (to use the common expression) that belong to the same class as the oyster or the cockle, agree in the general structure of the gills or breathing organs. These are placed between the folds of what is called the cloak or mantle, and are strengthened by delicate-jointed filaments. These, again, support numerous rows of very minute hair-like bodies, termed *cilia,* whose ceaseless movements cause currents in the water, and these currents convey to the animal the means of respiration and of nutrition. If any of you can procure a microscope, and can find a common Mussel in a living state, break the shell, cut off a small piece of the branchial fringe, and place it in focus along with a drop or two of sea-water. You will then see a framework of little bars with curious cross-joinings, and thousands of the minute hair-like bodies (*cilia*) in ceaseless movement. It is a sight which I shall never forget. It excited in my mind the most lively emotion of surprise. And when I considered that in the bay were millions of mussels, every one of which contained an apparatus equally perfect, I could not but ponder on the evidence thus afforded of the Power by which they were created, and the Providence by which they were preserved. The humble mollusc, resting on its bed of mud, seemed to speak, in tones not to be misunderstood, of "the works of the Lord, and his wonders in the deep." All bivalves, however, that burrow in sand or mud, are furnished with tubes instead of *cilia:* by one of these the pure stream is received and conveyed to the gills; by the other, the exhausted or impure water is carried away. Sometimes these tubes are separate, sometimes they are enclosed in a common sheath, their length and their power of extension being exactly adapted in all cases to the wants of the animal. If it merely cover itself in the sand, they are short; if it burrow deep, they can be protruded so as to reach the surface. If their free action should be impeded, and the communication between the animal and the surrounding sea-water cut off, death would ensue. We are thus enabled to find a clue to the origin of the mysterious dance. The water was full of currents caused by the little bivalves, each of which had one stream hurrying towards the entrance of its respiratory tube, and one issuing from the other orifice, and consisting of water that had fulfilled its functions and was no longer required.

A boring bivalve of larger size, called the *Pholas dactylus*, has the mantle prolonged into a thick rounded tube with two orifices, one of which is extremely contractile. These tubes form the only means of communication between the anchorite who inhabits the cell, and the world without. The animal, when very young, commences his excavation, lives in the cavern he has formed, and enlarges it from time to time as his increasing size requires. There his whole life is passed; he is the solitary inmate of the grotto he has constructed. Even were he desirous of leaving his abode, escape would be impossible; for the thick end of the shell, which possesses the perforating power, is placed below. The Pholas might well say, like Sterne's starling, "I cannot get out." Yet he does not want for splendours which more gorgeous dwellings cannot display; for his is lighted up by means of a phosphoric secretion. Superior to our railway engineers, he makes his tunnel with tools that are never out of repair, and illuminates every part of it with a bluish-white light, supplied abundantly, yet free of all expense. On one occasion a friend of mine collected a number of specimens, and carried them home in a botanical box. On opening it at night the interior of the box was one blaze of light!

4. The Shell of Molluscs.—The process of respiration, admirable as it is, and carried on by organs beautifully modified according to the necessities of the several groups, is not the only one which well deserves our consideration. The secretion of the material of which the shell itself is composed offers an interesting subject for inquiry. It is now ascertained that the formation of the shelly matter, and its application for the repair or enlargement

of the shell, is due to the part known as the "mantle." Each layer of the shell first formed, in fact, a portion of the mantle, either as a membrane only, or as a layer of cells. Hence shells consist in part of animal membrane, and in part of carbonate of lime; the minute cells of which they are built up presenting in different families considerable variety in their size, form, and arrangement. The observations of Lieutenant Maury, of the United States Navy, in his *Physical Geography of the Sea*, teach us to connect this deposition of shelly matter, whether by the coral builders of warmer latitudes, or the mollusca of our own coasts, with some of those large operations of nature that are ever going forward. The following are his words :—

"The dews, the rains, and the rivers, are continually dissolving certain minerals of the earth, and carrying them off to the sea. This is an accumulative process; and if it were not compensated, the sea would finally become, as the Dead Sea is, saturated with salt, and, therefore, unsuitable for the habitation of many fish.

"The sea-shells and marine insects afford the required compensation. They are the conservators of the ocean. As the salts are emptied into the sea, these creatures secrete them again, and pile them up in solid masses, to serve as the basis of islands and continents, to be in the process of ages upheaved into dry land, and then again dissolved by the dews and rains, and washed by the rivers away into the sea."

But they do not merely collect and condense the mineral constituents which the sea-water contains; they are, according to Maury, important agents in causing a continual movement in the particles of the sea-water itself, and causing successive portions of it to rise to the surface. If the sea were in a state of perfect rest, and a single mollusc abstract from it the solid matter for its cell, the specific gravity of that portion is altered. It has become lighter than it was before; it must, therefore, give place to the pressure which the heavier water exerts to push it aside and to occupy its place. "The sea-breeze," says Maury, "plays upon the surface; it converts only fresh water into vapour, and leaves the solid matter behind. The surface-water thus becomes specifically heavier, and sinks. On the other hand, the little marine architect below, as he works upon his coral edifice at the bottom, abstracts from the water there a portion of its solid contents; it, therefore, becomes specifically lighter, and up it goes, ascending to the top with increased velocity, to take the place of the descending column, which, by the action of the winds, has been sent down loaded with fresh food and materials for the busy little mason in the depths below."

CRABS.

> "Oh! what an endlesse work have I in hand,
> To count the sea's abundant progeny!
> Whose fruitful seede farre passeth those in land."—SPENSER.

1. THE SHORE CRAB.—On the moist sand of the bay, during the summer months, the young of the common Shore Crab (*Carcinus mœnas*) are very abundant. They are of various sizes, some of them being so small, that a silver fourpence laid upon "the shell" would cover the entire animal. They are of various colours, too; for while most of those which are full-grown are of a blackish-green above, and of a reddish tinge at the lower part of the body, the "children" sometimes appear arrayed in white, or in a mottled costume of white and black. It is pleasant to note how rapidly they run, and with what quickness they can sink down into the soft sand for concealment. Now and then when we turn up a stone, or lift a mass of sea-weed out of the little pool at its base, a full-grown crab, disturbed in his retreat, will rush forth, and with up-lifted claws offer battle to all assailants.

Occasionally, we have come upon some poor fellow who had cast his old shell, and whose new one had not yet become hard or crust-like. He generally at such times stays at home, and keeps quiet, as if aware that his usual armour no longer protects him from injury. It is a great pleasure to children at such times, to take the defenceless warrior in their hands, and after satisfying themselves that he is in his undress, and not prepared for visitors, gently to replace him in his chamber—a pleasant nook of a little pool of sea-water, the floor of fine sand, and the drapery of sea-weeds hung with a grace which man would try in vain to emulate.

From this crust or shelly covering, is derived the name of the *class* to which crabs and their relatives belong—CRUSTACEA. They are also jointed animals, belonging to the same great division of the animal kingdom as beetles and other insects, and all these together get the general name of ARTICULATA. They might be said, therefore, to represent in the sea, the active tribes of flesh-eating and carrion-loving beetles on land. As a necessary condition for such a life, whether in sea or in fresh water, they are formed for aquatic respiration—in other words, they breathe by gills (or *branchiæ.*)

To the children of a sea-side village, the common or Shore crab will, in most cases, be as well known as the common frog is to children living in an inland district. On one occasion I made it the subject of a short address to a school, and as it may be interesting to other boys and girls, I shall give it here.

'I am going to tell you to-day about the Common Crab; not the large crab which we see in the markets, but the one that we find running on the sands and lurking among sea-weed; the crab that in some places is best known by the name of the "parten," and which may very properly be called the Shore crab.

'If a boy, a whiting, and a crab, were placed in sea-water and covered by it, the boy would be drowned, the fish and the crab would be safe. If, on the contrary, all were placed on the strand, the fish would die, while the boy and the crab would be uninjured. Hence it appears that the crab can live where the boy cannot live; and that it can also live where the fish would perish. Let us see how this happens.

'You and I breathe by means of lungs, which are in that part of the body called the chest. Every breath we draw fills the chest with air, and this acts upon the blood in the lungs; this air is driven out of the chest, fresh air is inhaled, and thus the act of breathing goes on. The fish, on the contrary, does not breathe by lungs, but by gills, and they cannot act except when the water is flowing through them. We die if deprived of air; the fish dies if deprived of water in which air is contained, because it is by means of the water that it gets the air necessary for its existence. The breathing organs of the crab are quite different; so long as they are moist the crab can breathe. It has gills, which you can see in any dead crab, but these do not require a current of water to pass through them, like those of a fish; they are wetted when the tide comes in, and this keeps them moist while the crabs are running on the sand at low-water.

'Tell me now, when you take a crab in your hand, does it feel hard or soft? It feels hard, you say. Why does it do so?

'"Because it is covered with a hard crust or shell."

'Very good. Now, suppose a little crab has got this hard covering over its body, how is it ever to grow any bigger? A Snail can add a piece to its shell, and thus make its house larger when it wishes to do so. A Mussel or an Oyster can also make its shell larger by adding to it; but what is the crab to do? How is it to get out of the shell, if that be needful? and where or how is it to get a larger one? I will tell you how. The shell bursts, the crab leaves it; and, as it is now quite naked and unprotected, it keeps out of the way of danger until it has got its new suit of clothes. If any of you boys were getting a new pair of trousers, they might be too long or too short; they might have to be "taken in" a little bit, or "let out" a little bit. But the suit of clothes for the crab is sure to fit; for it is formed on the skin of the body, and moulded to the proper size in every part. Thus the crab, as it grows larger, is supplied from time to time with a new covering.

'We will now talk of another matter. Suppose that a boy should fall down in the street, and a loaded cart pass over one of his legs, crushing the bone to pieces, What would be done with him?

'"The surgeon would cut off his leg, and he would have to be content with a wooden one," is the reply.

'Suppose now that you were throwing a stone into the tide, and that it fell on the leg of a crab and crushed it to pieces, What would be done for the poor crab? There is no surgeon to cut the leg off, nor to get a wooden leg made for him. The crab is, however, quite independent of such assistance; he would fling off the broken leg at the joint above the broken part, and a new leg would grow, and in time become as large and as useful in every respect as the one that was there at first.

'Crabs, after they leave the egg, swim about, and are quite different in shape and appearance from what they afterwards become. Some of them are males and some are females.

'I have seen boys pelting the "parten" with stones, breaking off the nippers, and tormenting it in other ways. Let me ask; Has the crab ever done you any harm, beyond, perhaps, giving you a bite when you were plaguing it? Has it ever done you any good? You say you don't know. Let me tell you how it has done you good; how it has done me good; how it has done good to all about us. You know many dead bodies of various kinds are thrown into the sea; many are carried into it by rivers; many animals die there. If all those bodies were allowed to rot, and each day added to their number, the sea would become unfit for any creature to live in, and it would give out a stench that would kill those that lived on the neighbouring land. To prevent such a result, it has been wisely ordained by Him whose word has called all living things into existence, that there should be multitudes of animals to feed on dead and decaying bodies, and find their best nourishment in what would otherwise become injurious. The common Shore crab is one of those creatures; it is one of a large body of scavengers, appointed to perform a certain duty, and by doing it, becomes the means of conferring a great benefit on larger animals, and even on man himself.'

Such was my short lecture. Would that it might cause those by whom it is read to look with greater interest on the humble Shore crab! and to find profitable matter for reflection in its peculiarities of structure, and the uses which they serve.

2. SEA-SCAVENGERS.—Another animal which aids in the removal of dead or decaying substances, and which belongs to the same class as the crab, but to a different division of it, is the little jumping creature known as the Sand-hopper (*Talitrus locusta*). A singular instance of their voracity came under my notice, on the Antrim coast, within a few miles of the Giant's Causeway. The surface of the sea was agitated, at a short distance from the land, by a shoal of fish; they were Gurnards, and were leaping and tumbling about with great activity. They had approached the beach, in order to prey on an immense shoal of young herrings, numbers of which, driven in by the larger fish, were cast up by the swell of the sea on the moist sand. They were each about two and a half inches long, and by their brightness were attractive objects, contrasted with the strand on which they lay. But they were not allowed to remain long undisturbed; hosts of Sand-hoppers made them their prey, even in some cases before life was extinct, and with such rapidity and efficiency were their operations carried

on, that delicate skeletons of the young herrings soon strewed the shore, cleansed so effectually from the flesh, that the sea-breeze was sufficient to carry them away. The Sand-hoppers in their turn became the prey of active little shore-birds, the sand-pipers—another example of the universal law "to eat and to be eaten." How suggestive of the beneficence that dwells under all this destruction are the lines of the poet:—

> "While ravening death of slaughter ne'er grew weary
> Life multiplied the immortal meal as fast.
> War, reckless, universal war prevail'd,
> All were devourers, all in turn devour'd;
> Yet every unit in the uncounted sum
> Of victims, had its share of bliss, its pang,
> And but a pang of dissolution; each
> Was happy till its moment came, and then
> Its first, last suffering, unforeseen, unfear'd,
> Closed, with one struggle, pain and life for ever."—MONTGOMERY.

The sea-scavengers, even among those that are the brethren and cousins of the shore-crab, are not limited to the beach; some of them dwell habitually in deeper water. One of these, the spinous Spider crab, after being taken prisoner in a lobster-pot, was transferred to a boat, and became the fellow-passenger of the Rev. Charles Kingsley, the gifted author of *Glaucus*, who in that charming little volume has thus introduced to our notice the ungainly crustacean, and his sanitary vigilance, when labouring "in his vocation:"—

"In the boat, at the minute of which I have been speaking, silent and neglected, sat a fellow-passenger, who was a greater adept at removing nuisances than the whole Board of Health put together, and who had done his work, too, with a cheapness unparalleled, for all his good deeds had not, as yet, cost the State one penny. True, he lived by his business, as do other inspectors of nuisances; but Nature, instead of paying Maia Squinado, Esquire, some five hundred pounds sterling per annum for his labour, had contrived, with a sublime simplicity of economy which Mr. Hume might have envied and admired afar off, to make him do his work gratis, by giving him the nuisances as his perquisites, and teaching him how to eat them. . . . Last night, as he was sitting quietly under a stone in four fathoms' water, he became aware, whether by sight, smell, or that mysterious sixth sense, to us unknown, which seems to reside in his delicate feelers, of a palpable nuisance somewhere in the neighbourhood, and, like a trusty servant of the public, turned out of his bed instantly, and went in search, till he discovered, hanging among what he judged to be the stems of tangle (*Laminaria*), three or four large pieces of stale thornback, of most evil savour, and highly prejudicial to the purity of the sea, and the health of the neighbouring herrings.

"Nature, who can afford to be arbitrary, because she is perfect, and to give her servants irresponsible powers, because she has trained them to their work, had bestowed on him and on his forefathers, as general health inspectors, those very summary powers of entrance and removal in the watery realms for which common sense, public opinion, and private philanthropy, are still entreating vainly in the terrestrial realms; so finding a hole, in he went, and began to remove the nuisance, without 'waiting twenty-four hours,' 'laying an information,' 'serving a notice,' or any other vain delay. The evil was there, and there it should not stay; so, having neither cart nor barrow, he just began putting it into his stomach, and in the meanwhile set his assistants to work likewise. For suppose not, gentle reader, that squinado went alone; in his train were more than a hundred thousand as good as he, each in his office, and as cheaply paid; who needed no cumbrous baggage-train of force-pumps, hose, chloride of lime packets, whitewash, pails, or brushes, but were every man his own instrument; and, to save expense of transit, just grew on Squinado's back."

The army of pigmy assistants conveyed by Squinado to the field of action was of course a little forest of growing corallines, each seeming plant containing numerous cells, every one of which was occupied by its proper inhabitant. Into the history of these tribes, however interesting, I do not at present propose to enter. Neither can I dwell on another corps of the sanitary marine police, the Star-fishes.[1] These creatures are both numerous and voracious, and render good service around the coast, from the shallow shores even so far as the deep water known as the region of corallines.

3. THE HERMIT CRAB.—I shall now speak of the paguri or Hermit crabs. They are not coated all over, like the crab or the lobster, the hinder part of the body being soft, and without any shelly covering whatsoever. The hermit crab, conscious of his defenceless condition, seeks out an empty univalve shell, such as that of the whelk or the periwinkle, and into it he retreats, the

[1] The "five-fingers" is one of the animals to which I refer. The sea-blubber or sea-nettles, though sometimes called star-fishes, belong to a different class.

two formidable-looking pincers, and two well-protected pairs of feet, filling the mouth of the shell, or protruding beyond it. The tail is not shaped like that of the common crab, neither is it fan-like, as in the lobster, but is unsymmetrical, and is furnished with hooks, which enable him to retain a good hold of the castle he has acquired. When he outgrows his dwelling he leaves it and searches for another, thrusting the tail into it to try if it gives him the accommodation he wants and pleases his fancy. If it does, he takes possession.

The right to a tenement is, however, attended occasionally by a contest. For why?—

> "Because the good old rule
> Sufficeth them, the simple plan
> That those should take who have the power,
> And those should keep who can."

There is reason to believe that this struggle is not always limited to the houseless wanderer, who battles with a rival, or endeavours to dislodge him, but at times involves the death of the real owner, the mollusc by whom the shell was formed. Professor Bell says:—

"It is a question of some interest whether the hermit crab always chooses for its habitation a shell already empty, or whether it actually kills and devours the inhabitant of one that suits its size, and then takes possession of its violated home. The latter I believe to be true, in many if not in most cases; certainly, however, not in all, as we often find the hermit occupying an old and long-abandoned shell. But so much more generally is it found in fresh shells that it can scarcely be doubted, even on this ground alone, that it often obtains its habitation by violence. The fishermen on the coast are fully persuaded of this; and an intelligent person of this class at Bognor, assured me that the fact has often been observed by himself and others. He stated that the aggressor seizes his victim—the whelk, for instance—immediately behind the head, and thus kills or disables it, then eats it, and finally creeps into and appropriates its vacant shell."

In the literature connected with zoology we come at times upon an instance of a fable being adopted as a fact; and again upon the very reverse, the fact being rejected as a fable. Such was the fate of the one just mentioned; for so strange and marvellous did it appear to the renowned Swammerdan, that he rejected it as false, and regarded the hermit crab as the original tenant of the shell. Let us profit by the errors as well as by the truthful labours of those who have gone before us, ever bearing in mind that "free and unprejudiced spirits will neither antiquate truth for the oldness of the notion, nor slight her for looking young, or bearing the face of novelty."

Mention has already been made of a crab carrying on his back a host of minute zoophytes. The larger hermit crabs also carry animal life of other kinds upon their dwellings. *Serpulæ* and other worms that live in tubes, there fix themselves; acorn-shells take up their resting-place, and spread out their curious casting-nets to seize their prey. Sponges also select them, and occasionally, like other parasites, destroy their benefactors. On different occasions, however, I have dredged up a hermit crab, who seemed more happily circumstanced, for his companion was a very beautiful species of sea-anemone (*Adamsia palliata*). The late Rev. Dr. Landsborough refers to it in the following passage, which is taken from his *Excursions to the Island of Arran*:—"Many naturalists have observed that there seems to be a treaty of union betwixt the hermit crab and the spotted sea-anemone. On this occasion we found that the spotted anemone had fastened itself to the outer lip of many of the *roaring buckies* (*Buccinum undatum*) brought up by the dredge, and wherever there was an anemone without, there we found a hermit crab within. In all likelihood they in various ways aid each other. The hermit has strong claws, and while he is feasting on the food he has caught, many spare crumbs may fall to the share of his gentle-looking companion. But soft and gentle-looking though the actinia be, she has a hundred hands, and woe to the wandering wight who comes within reach of one of them, for all the others are instantly brought to its aid, and the hermit may soon find that he is more than compensated for the crumbs that fell from his own booty." I cannot venture to add any surmise as to the proportionate gain of the bustling crab and his attractive partner, but I may mention a circumstance that occurred when death had dissolved their partnership. I had placed them in my glass tank with other marine creatures. The crab died. Next day we found that the anemone had forsaken the empty shell, and fixed herself elsewhere. She did not long survive; nor were her beauties ever displayed as they had been while on the shell.

The hermit crab has been known to carry a heavier burden than the one just mentioned. One of them, of the largest species (*Pagurus Bernhardus*), was in a tank in the Royal Zoological Gardens at Dublin. In walking about with his capacious shell (*Buccinum undatum*), he happened to come close to one of the largest sea-anemones that live upon the shores (*Actinia crassicomis*). This creature would appear to have powers of discrimination beyond what is generally supposed, for it immediately seized the shell and fixed itself upon it. There it remained as immovable as the old man of the mountain on the back of Sinbad. In ordinary cases, the anemone draws back its feelers when they are touched. But now, when the crab rushed about, and knocked the anemone against various objects in his progress, these sensitive organs were never retracted; the knocks were taken as things of course, and not allowed to interfere with the enjoyment of the ride on *crab*-back.

A native species of crab (*Hyas araneus*) has been known to bear a still heavier burden. The upper shell (*carapace*) of the crab was two inches and a quarter in length, and on it an oyster three inches in length had attached itself. On the oyster shell, which was apparently five or six years old, were many large acorn-shells (*Balani*), so that the crab, Atlas-like, must have borne a world of weight upon its shoulders. So long as a crab goes on increasing in size, its shell, as already mentioned, is cast off and renewed. But it had not been cast off since the time the oyster made good its settlement upon it. Hence the presence of this oyster affords interesting evidence that the hyas lived several years after attaining its full growth.[1] Both crabs and oysters, though dead, were in a fresh state when brought to the naturalist, in whose cabinet they are now preserved.

Perhaps some of the active merry boys, by whom these pages are read, may be so fortunate as to add to our present knowledge such materials as may assist in determining the average longevity of some of our native crustacea,—what length of life in them would represent the "three-score years and ten" of human existence.

[1] Thompson's *Natural History of Ireland*, vol. iv.

SEA-ANEMONES.

"The living flower that rooted to the rock,
Late from the thinner element,
Shrunk down within its purple stem to sleep,
Now feels the water, and again
Awakening, blossoms out
All its green anther-necks."—SOUTHEY.

1. SEA-SIDE EXCURSION.—I had brought with me to the country one of those tanks which are now sold in London for keeping aquatic animals and plants in a living state. It was about eighteen inches long, and nearly a foot deep. A little piece of rockwork had been made in the centre, and at each of the corners a stone had been placed on which was a sea-weed, whose dark-green stems reached nearly to the surface of the water. The slate-bottom of the tank was covered with roundish white pebbles. The glass sides were clean and bright, the sea-water was pure, and every now and then bubbles of oxygen gas were given out by the plants, and rose sparkling to the surface. The house was ready, but those who were to be its inmates had not yet arrived.

Resolved that it should not remain any longer unoccupied, I summoned three children, who, with great alacrity, got ready for a stroll upon the beach. We carried with us a basket containing some wide-mouthed glass vessels, a small spade, a stout knife, a tin box, and a can for sea-water. In ten minutes we stood among little ledges of rock, which were at low-water laid bare to our research. Some of them were clothed with the most common kinds of brown sea-weed, and among them were little sandy havens and rocky pools, each of which, like rival candidates for our favour, displayed attractions of its own.

The children set to work to collect for the tank. They wanted sea-anemones of every variety of colour, brown, yellow, olive, green, scarlet, and vermilion, for such, and so varied are the tints of the most common species (*Actinia mesembryanthemum*). While they are so employed, let me tell my young readers what is meant by a Sea-Anemone.

The Sea-Anemone is a lowly member of the animal kingdom, and belongs to the class of *Zoophytes* or "plant-animals," a name which reminds us, that, in former times, they were supposed to occupy a place between animals on the one hand, and plants on the other. On the sides of the rocks, and under the sea-weed, about the base, are soft fleshy hemispherical bodies, of different tints, but mostly liver-coloured or brown. These are sea-anemones in their contracted state. To judge of what they are when expanded, look into that little rock-basin, and you will see half a dozen of them spread out as if they were the favoured flowers of a sea-maid's garden :

> "The marigold that goes to bed with the sun
> And with him rises weeping,"

is not more beautiful. Stoop down and touch the expanded blossom. The moment that you do so its petals begin to close ; you find your finger is seized, and that it is held not by pressure only, but by some adhesive secretion. You cannot doubt that any small animal, a wandering crab, or a luckless shell-fish, would have no chance of escape, but would be consigned forthwith to the central mouth, which gives ready access to the capacious stomach beneath. I have given a sea-anemone for his dinner a cockle as large as himself. He contrived to swallow it entire, and next day rejected by the mouth the undigested remains of the shell. Another time I dropped a periwinkle [1] into the gaping mouth ; in an hour or two afterwards, it was creeping about as usual : the sea-anemone had not chosen to eat. A friend informs me, he, in like manner, dropped in a small crab ; next day he saw the crab walking about as usual, but wanting one of his legs. The anemone can bear long abstinence and changes of temperature. It can even bear removal from water for many successive hours. On one occasion, when I was writing, a child brought a sea-anemone in his hand to show to me. He left it in one of the divisions of the writing-desk without my knowledge. The desk was locked. On opening it on the third day afterwards the luckless sea-anemone was discovered, and being placed in a glass of sea-water, expanded itself as usual. But these grievances are trifling compared to some to which it is occasionally subjected, and which it survives. If cut down right in two, each part will reproduce what is deficient, and two anemones will result. If cut across, the upper part will continue to take food,

[1] On both the Scotch and Irish coast, this is more commonly called "whelk."

though lacking a stomach in which it can be retained; and each of the several portions will in time become complete. The marvellous story of Baron Munchausen's horse, that attempted to drink after the battle in which the body had been cut in two, meets here with an incident of a somewhat analogous kind, but with this difference, that what was a flight of invention as regards the horse, becomes a sober matter of fact as regards the anemone.

But what have the children been about all this time? They have been collecting a dozen or more of the choicest sea-anemones they could select. Their little fingers have detached them gently from the rocks, without injury to the expanded part by which they were fastened. A rosy little sun-star, about the size of a shilling, has been transferred to one of the jars, and has, as his companion, a very attractive-looking shrimp. Two or three little hermit crabs, a venerable-looking limpet, carrying on his back a whole company of diminutive companions, and some "silver shells" (*Trochi*), are now the inmates of another vessel; and thus supplied we turn our faces homewards.

But we had not gone twenty yards, when the quick eyes of one of my little companions detected a gorgeous sea-anemone in a pool close to one of the rocks. Bright streaks of vermilion were across his surface. The petal-like feelers or "tentacula," were not tapering as in the former species, but thick and semi-transparent. We gathered round, and after admiring his beauties, resolved to make him a captive. But at the first alarm he drew himself up and disappeared. Where the splendid corolla had been unfolded, we saw, when the water had cleared a little, only a heap of sand and gravel. What had become of him? He was there still, but the warty skin, covered over with gravel, was alone visible; the delicate-looking flower was closed. After some difficulty, I got him separated from the stone to which he was adherent, and tossing him into our little can of sea-water, we marched off the field, bearing joyfully with us the trophies of our success. That night the tank was no longer solitary.

Next morning the large sea-anemone was quite at home. He occupied a position in front of the little central rock-work, and was so gorgeously arrayed that he seemed the monarch of the scene, and all the others, with liveries of various colours, his attendants. To convey to my readers some idea of his beauty, I cannot do better than quote the words of Sir John Dalyell:—

"No species is equally diversified in colour and aspect. Red is usually predominant. The surface of many, however, is variegated red and white like a rose, or with orange-green and yellow intermixed. One occurred almost totally white; another, wholly primrose-yellow. It may be truly affirmed that the diversities baffle enumeration and description." A French writer had borne testimony to the excellence of this species (*Actinia crassicornis*) for the table, after being boiled in sea-water; but though he expressly says they are, when cooked, of an inviting appearance, I never ventured to make trial of them. Mr. Gosse was, however, more courageous, and states, from his experience, that they "are certainly far superior to cockles, periwinkles, and mussels."

In a day or two more my tank received a welcome addition, consisting of the fan-shaped fronds of a kind of sea-weed, sold when dried under the name of Carrageen moss (*Chondrus crispus*). The children brought home for me a number of pieces of rock on which the "moss" was growing; and for themselves, a basket of it "to make a feast." When boiled, it furnishes a kind of gelatine, "and they," to use the words of Dr. Landsborough, "who have tasted it once with good rich cream, will need no coaxing to partake of it a second time." In the tank it gave, in its growing state, an addition to the supply of oxygen.

2. The Daisy Anemone and the Anthea.—I now wanted some of the daisy anemones (*Actinia bellis*). The word *actinia*, which I have applied to this and to the two other species already mentioned, means literally "a ray." Look at any one of these animals, and you will admit that this generic term is not inappropriate. The sea-anemone is, therefore, a rayed or radiated animal, and belongs to a group quite distinct from the soft-bodied molluscs or the jointed crustacea. The daisy anemone was a species not got near to my residence, but which I noticed a year before in great abundance in a rock-pool about seven miles distant. They covered its sides, as grey lichens occasionally encrust a rock, and were difficult to remove; but with a little care and perseverance I had succeeded in doing so, without the troublesome operation of chiselling off the pieces of rock to which they were attached. Some thus obtained had lived under my care during the winter, and had been given away when the season for another sojourn at the sea-side again came round.

I applied to a friend who was resident near the locality to supply my want, and soon I received a consignment of fine healthy specimens, not of one species only, but of two.

One of these was the Daisy-anemone, my old acquaintance; one that, when once known, can never be forgotten. I cannot attempt to describe its shape, for that is ever changing when the animal is vigorous and healthy; the woodcuts given by Dr. Johnston, in his *History of British Zoophytes*, p. 231, convey, however, some idea of their variety. The most distinguishing characteristic is the wavy outline of the disk—the beautifully festooned appearance of its margin. Its diameter is from one to one and a half inch. The *tentacula*—as the arms or feelers are called—are ringed with white; the base of each of the inner tentacula, dark brown; colour of the body in its contracted state, whitish or pale flesh colour; the back part of the expanded corolla, and the stem covered with numerous whitish warts. None of my specimens presented the purple or crimson tints, which they elsewhere exhibit.

The other was the Anthea (*A. cereus*). While my friend was searching for the daisy anemone he came upon a pool, which was partially fringed with the Anthea. Its colour is generally of a light chestnut, or a brown inclining to amber. Occasionally it is a dull ash-colour throughout; and some individuals are green, with the tentacula tipped with red. These singular organs are longer than the body, and are kept in almost constant motion, twisting about like so many young snakes. The Anthea is fond of changing his place, moving about in the tank from one part to another; sometimes fixing itself on the sides, the body gracefully curved, and the tentacula hanging down. Two of them were placed on the summit of my little rockwork, and quickly attached themselves. They completed the picture.

One morning, on coming down to breakfast, I found two of my Antheas had a strange appearance. The bodies were contracted, and the colour changed to lavender, while the tentacula had become white. I feared they were going to die. But my apprehensions were groundless; next morning they had again assumed their ordinary aspect. I had on one occasion the pleasure of seeing the anthea under circumstances that I will not readily forget. Outside the belt of sand and rocks that is left uncovered at every tide, is another where the large sea-weeds, such as the tangle and seafurbelows flourish. These plants belong to the genus *Laminaria;* and this zone is, therefore, known as the Laminarian Zone. As our boat drew nigh to the shore, the large spreading fronds of the sea-weed became more and more distinct, until each was perfectly revealed to us below the unruffled surface of the sea. We had come at the time of low water, and as we floated quietly onward could mark the glorious submarine forest which was beneath our boat. It rose and fell, it heaved and sunk, as gracefully as the meadow yields to the breeze, or as the willows bow to the breath of April. As we came into shallower water, the broad out-spread leaves, or, more correctly, the "fronds" of the sea-weed, seemed studded with blossoms. What could they be? A few moments more disclosed the mystery—each blossom was endued with life and motion—it was a living Anthea! How true and accurate are the lines of the poet Southey—

> "Here, too, were living flowers,
> Which, like a bud comparted,
> Their purple cups contracted;
> And now, in open blossom spread,
> Stretch'd like green anthers many a seeking head."

And now a new phase of its peculiaritics was made known to me; it possessed a stinging power. I felt it on my hands, as one after another I removed the Antheas from their attachment, and placed them in glass vessels for conveyance home. I had read of this, but had never experienced it before; but now it was no longer a matter of hearsay, it was a fact brought within my own experience. The feeling, was, however, slight and transient.

The scene just witnessed was one suggestive of thought. What varied forms of animal life inhabited that Laminarian forest! Fishes instead of birds played among its branches; crustacea climbed on its stems, and swam from leaf to leaf. Molluscs carrying their breathing organs on their backs, decked with gayest colours, or bearing shells of various forms, glided over the fronds. Annelids unfolded their gorgeous plumes, or shone with iridescent tints, not surpassed even by the humming-birds of tropical climes. And over and above this manifold display of animal life, each plant supported colonies of zoophytes growing like miniature sea-plants, and creatures gifted with a more complex organization spreading their tiny dwellings like a delicate network on the stems, or over the surface of the fronds. This miniature existence is to be reckoned on a single plant, not by thousands, but by millions. What, then, must be the amount of life in that "populous solitude" comprised in a few hundred yards of a rocky coast? How wonderful the diversity of structure, function, habit, and instinct, there displayed! Well may we say with the Psalmist, "O Lord, how manifold are thy works! in wisdom hast thou made them all: the earth is full of thy riches: so is this great and wide sea, wherein are things creeping innumerable, both small and great beasts."

Before concluding this subject, let me recall to your mind the four great Divisions or Groups of the Animal Kingdom:[1]—

1. The animals belonging to the first of these Groups are distinguished by the possession of a skull and vertebral column or backbone, and are hence called *Vertebrate* animals, or *Vertebrata.*

2. Those belonging to the second Group have, among other characteristics, the body covered with a skin, which is moist and soft; and from this circumstance they are termed *Mollusca.*

3. Those comprised in the third Group have a jointed structure, and, as the word *articulus* means a little joint, they are termed *Articulata.*

4. Those of the fourth Group, or such of them as are the most fitting representatives of its characteristics, have a rayed structure, either in the outline of the body or in the arrangement of its parts; and are hence known as rayed animals, or *Radiata.*

Each of these Groups of animals exhibits well-marked modifications of the nervous system, so that they are distinguishable both by internal structure and by external appearance.

Each Group is subdivided into smaller groups, termed Classes. Classes are again divided into Orders; Orders, into Families; Families, into Genera; and Genera, into Species.

The following table will convey a general idea of the manner in which animals are distributed among the several classes:—

[1] To Baron Cuvier, whose death took place so recently as 1832, we are indebted for that division of the animal kingdom into four great groups or sub-kingdoms, which naturalists from his time have generally adopted. For further information, I would refer the reader to my *Zoology for Schools*, and *Zoological Diagrams.*

I.—Vertebrata.

With a skull and vertebral column.

(Warm-blooded).

Class I.—Mammalia, or suck-giving animals, such as man, monkey, bat, whale, dog, &c.

II.—Aves, or birds, as eagle, sparrow, pigeon, heron, duck.

(Cold-blooded).

III.—Reptilia, or reptiles, as tortoise, lizard, snake, frog.

IV.—Pisces, or fishes, as perch, herring, eel, shark, &c.

[Invertebrata.]

Animals which are destitute of skull and vertebral column.

II.—Mollusca.

Soft-bodied Animals.

Cuttle-fishes, snails, limpets, &c.; oyster, cockle, &c.; sea-squirt.

III.—Articulata.

Jointed Animals.

Spiders and scorpions; insects, as beetles, crickets, dragon-flies, bees, butterflies, and moths, bug, gnat, flea, &c.

Crustacea, those which have a covering similar to that of the water-flea, the crab, lobster, &c.

Barnacles and acorn-shells, worms and leeches.

IV.—Radiata.

Rayed Animals.

Star-fishes and sea-urchins—jelly-fishes—zoophytes—internal worms—infusory animalcules—minute chambered shells—sponges.

In the preceding pages I have given four chapters upon animals; and these may be regarded as representing the four great or primary groups, as above enumerated.

But the learner should ever bear in mind that classification is not fixed and unchangeable, but that it must from time to time undergo a revision, in order that it may be in conformity with our increasing knowledge of the structure, development, and habits of animals, and the affinities which they bear to each other.

LESSONS ON PHYSICS.

PROPERTIES OF MATTER.

Form.—The word Form is susceptible of a variety of significations. It is desirable to include them all. In the sense of aggregation of particles, the most obvious divisions of Form are the solid, the fluid, and the gaseous. It is probable that all substances are capable of being changed from any one of these forms to any other, by the application or the abstraction of heat. Water becomes steam by the former agency, and ice by the latter. Lead, which is usually seen as a solid, is easily melted, and when in that state rapidly escapes in the shape of vapour. On the other hand, many gases have, by the united influence of cold and pressure, been converted into liquids and solids. Another signification of the word Form makes it equivalent to shape,—as when the form of a body is said to be spherical, or that of a surface to be square. The same word is also employed to designate the structure of a body. In this sense the form may be crystalline as glass, fibrous as wood, or amorphous as clay.

From what has been said, it will be evident that under this manifold interpretation of the word Form, may be arranged a wide catalogue of the secondary qualities of bodies, such as density or heaviness, hardness and softness, ductility, tenacity, malleability, elasticity, &c. We shall explain the meaning of these terms.

Density is the most changeable of all the properties of matter. It varies with the temperature and the pressure to which bodies are subject. No doubt the ordinary changes in the size of solid bodies are but of small amount. They are indeed so small, that they are apt to escape detection. An example of contraction by cooling, which may perhaps have been noticed, occurs in the process of fitting the iron rim or tire to a wheel. The tire is put on when hot. As it cools, the metal contracts, and thus holds the wood-work with a firm grasp. The word density does not in all cases explain itself. It seems to imply a greater compactness or accumulation of particles in a dense body, without reference to the nature of the particles themselves. Another word or phrase is consequently necessary for the purpose of comparing different classes of bodies with regard to their weight.

Specific gravity is the phrase used to indicate the relative weights of the same volume of different substances. A sovereign is heavier than a shilling, but it is smaller. The specific gravity of gold is accordingly greater than that of silver. A cubic foot of water is heavier than the same volume of ice, and hence the specific gravity of water is properly said to be greater than that of ice. But when it is asserted, on the same grounds, that the density of water is greater than that of ice, a little explanation is requisite to make the assertion intelligible.

There is another property of matter which appears at first sight to depend on density, but which has in reality no connexion with it, viz. :—

Hardness.—Oak is harder than deal, and it is denser ; but whilst iron is harder than lead, it is not so dense ; its specific gravity is less.

Ductility.—A body which is capable of being drawn out, so as to have its length increased, is said to be ductile. This property is possessed in a greater or less degree by all the metals. Gold is the most ductile. An ounce of gold can be drawn into wire several miles in length ; and by coating silver with gold and then drawing it out, a single ounce may be made to extend to a length as great as the distance of Edinburgh from London.

Tenacity.—It is a remarkable fact, that although the density of the metal is somewhat diminished by drawing, yet the weight which it will sustain, as compared with its thickness, is increased. Thus, a bar of wrought-iron of one square inch in thickness will sustain thirty tons. But if it be drawn out into wire of one-thirtieth of a square inch, instead of sustaining only one ton, as it should do were its tenacity unchanged, it will sustain two tons. Hence a suspension-bridge hung on chain cables is much stronger than a similar bridge hung on solid iron cables of the same weight.

Wire cables are, however, apt to break after long use, probably from the iron becoming crystallized by friction and vibration.

Malleability.—This term is used to express the capacity which a substance has for being beaten or rolled out. Any attempt to beat or roll out glass is unsuccessful. It is, therefore, not malleable. Soft clay and dough are perfectly malleable. As a general rule, the more ductile substances are the more malleable. There are, however, some exceptions. Iron is more ductile than copper, but not so malleable. The malleability of metals is commonly increased by heat, and accordingly the smith heats his iron to a white heat, and as it cools beats it out into horse-shoes, &c. The beating also renders the metal denser and harder.

The divisibility of matter is one of those subjects which teach us the limited range of our senses. Although we can have little hesitation in believing that the ultimate particles of which matter is composed are of a definite size, still no limit towards which our senses enable us to approach seems at all near to the final point, beyond which no further march is possible. Thin as is paper, it is a thousand times as thick as the thinnest gold leaf. And the latter is found to be perfectly free from interstices. We must therefore conclude that the particles of matter, although not infinitely divisible, have a divisibility far beyond the reach of our senses.

Elasticity is that quality of certain bodies which enables them to recover their figure when it has been temporarily destroyed by violent bending or bruising. A saw is very elastic, but a sheet of lead is hardly so at all. A ball of ivory, when it falls on the ground, becomes slightly flattened, and its endeavour to recover its shape causes it to recoil from the ground. A ball of lead retains the indentation it has received, and does not recoil. The perfection with which bodies recover their figure is a measure of their elasticity. India-rubber is highly elastic ; unbaked clay possesses hardly any elasticity at all.

MECHANICAL FORCES.

We may define Force as *that which tends to produce motion.* The following are some of the more important mechanical forces.

1. *Universal gravitation.*—The principle known as universal

gravitation is this, that every particle of matter in the universe attracts every other particle with a force which varies inversely as the square of the distance, *i. e.*, when the distance is doubled, the force is reduced to one-fourth, when trebled, to one-ninth, and so on. This law satisfactorily explains the motions of the heavenly bodies. And so confident have mathematicians become of its universality, that they are disposed to refer any phenomena which it has failed to embrace rather to their ignorance of fact than to the inadequacy of the law. When certain unexplainable irregularities were detected in the most remote known planet, it was confidently asserted that there must exist some still more remote body, the faint light of which might possibly never affect mortal eyes, but which, by its attraction, was producing the observed irregularities in the movements of the other. With a true spirit of philosophic inquiry, elaborate calculations were undertaken to discover whereabouts the unknown planet might be situated. The result was, that on the telescopes of astronomers being directed to the part of the heavens which the calculations indicated, the planet Neptune was immediately discovered.

The principle of universal gravitation is then firmly established as the great law of the universe—the law which rules all *matter*. But there are certain elements in the constitution of bodies which exhibit small or temporary deviations from this law. These elements, of which we know nothing except through their effects, are called non-material. The definition of matter, indeed, may be, that it is subject to the law of gravitation; or, speaking of terrestrial matter, that *it has weight.* Thus gold, water, and air are material, whilst heat, light, and magnetism are immaterial. Whether these last are themselves substances in any sense, or are mere affections of matter, is a question not yet definitively answered. The popular belief is, that there exists a fluid infinitely more subtle than air, and that this fluid pervades all space, and flows freely amongst the particles of material bodies. To the movements and arrangements of the atoms of this fluid are attributed the phenomena of light, heat, &c. When, therefore, a stick of sealing-wax, after having been briskly rubbed on the coat-sleeve, is found to attract a feather, or when the pole of one magnet is found to repel the corresponding pole of another, neither of these phenomena must be regarded as having anything to do with the law of universal gravitation.

The attraction of one body towards another is so small, that it is quite inappreciable by our senses. The weight of a stone is due, not to its attraction towards the stones in its neighbourhood, but to its attraction by every particle of the globe. A moment's reflection will convince any one that if the united attractions of every portion of this vast mass suffices only to produce the small downward energy which we call weight, then the effect of even a mountain must be quite insignificant. Small as it is, however, the delicacy of astronomical instruments has enabled us to detect it. By suspending a plumb-line, *i.e.*, a string with a heavy ball attached to it, alternately on opposite sides of the mountain Schehallion, and by other means, it has been ascertained both that terrestrial matter does exert the attraction spoken of, and that the mass of the earth acts with a force which, on the whole, is between five and six times as great as if it were a globe of water of the same size.

2. *Gravity.*—It has been stated that the aggregate attraction of every portion of the mass of the earth on a body placed at its surface, tends to draw it towards the centre of the earth, or gives it weight. This aggregate is called the force of gravity. It diminishes as we ascend a mountain, or rise in the air in a balloon. But the change of weight on this account is very small indeed. A pound of lead balanced by a spring at the surface of the earth, would be found to have lost about three grains at the height of a mile.

3. *Capillary Attraction.*—Another action of one particle on those which lie around it, is that which takes place at the junction of a solid and a fluid. On examining the surface of a cup of tea or milk, it will be seen that it is curved upwards towards the margin. If the cup had contained quicksilver instead of tea, it would have been curved downwards. Possibly this phenomenon is a consequence of the law of universal gravitation; but in the absence of any exact knowledge of the arrangements of the particles of solid and fluid bodies, we can explain the facts only by the assumption of another law, viz., that the particles which are *very* near a given particle, exert an attraction on it which is vastly greater than the aggregate of the attractions of all the other portions of the body. This is called the law of molecular attraction. To it are referred the phenomena of cohesion, by which bodies hold together—of the ascent of water in a lump of sugar, and of soap in the vessels of plants—also of melting, and the consequent

tendency of water to escape through the pores of bodies, a tendency not due to its fluidity alone. Mercury is as fluid as water, but you may carry it in a pocket-handkerchief with safety.

4. *Animal Strength.*—This species of force needs no illustration. Suffice it to say, that when the amount of work a man or a horse can do has to be estimated, the measure is usually stated in the number of pounds which he can lift to the height of one foot in a day. A rough estimate of a man's work is, that he can lift 10 lbs. 10 feet in a second, and continue at his work ten hours in the day. A horse-power is usually reckoned at 33,000 lbs. raised a foot per minute, and is thus equivalent to that of five or six men.

5. *Friction.*—The forces which we have enumerated may be termed active forces; that which we have now to consider is properly a passive force—its tendency is to prevent motion. When two hard surfaces are completely smooth, the one slides on the other with great readiness—in skating, for example. But with ordinary surfaces such is not the case. By their attrition a force is called into play in the direction of the planes of contact, which resists their relative motion. This force plays a most important part in the economy of nature. Without friction it would be impossible to walk even on a level road. But, important as this force is, its agency will be left out of account when we treat of the equilibrium of machines, seeing that it does not act uniformly, nor even at all when the other forces are in equilibrium amongst themselves. The law of friction is, that it is proportional to the pressure, other things remaining the same, and does not depend on the size of the surfaces which are in contact. In going up a hill, the heavier you are, the more friction does the ground afford, but you experience the same amount whether you press the earth with the sole of your foot or with the toe only.

SOUND.

HOW SOUND TRAVELS, AND HOW FAST IT TRAVELS—ECHOES—MUSICAL NOTES.

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

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

How fast does the shock travel through the air; or, in other words, what is the velocity of sound? The answer is, about 1100 feet a second. It travels more quickly in warm than in cold weather. Through water it travels about five times as fast as through air.

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

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

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

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

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

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

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

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

LIGHT.

VELOCITY OF LIGHT—REFLECTION—REFRACTION—THE EYE—COLOUR.

Sect. 1. Some of the ancients believed that light issued from the eye. This is wrong; the eye sees bodies by the light which it *receives* from them. Some bodies, such as the sun, a candle, or a glowing coal, are themselves sources of light; other bodies again are visible because of the light shed upon them by luminous bodies, and have no light of their own. The moon is an example. When you look into your companion's face, too, you see it, not because it is luminous, but because it is *illuminated* by light from some other source, which light is sent from the face to your eyes. The eyes themselves are not luminous. Even a cat's eyes, which shine in the night, are not luminous; for if the animal be placed in perfect darkness, its eyes will not shine. The human eyes can, by proper means, be made to glow like a red-hot coal; but this is done by throwing light into them, and is not due to light which they themselves possess.

Light moves with an immense velocity. Our earth, you know, travels round the sun at an average distance from him of ninety-five millions of miles. There is another planet, called Jupiter, which also travels round the sun at a far greater distance from him than the earth. It is found, by the most accurate observations, that the light from Jupiter requires eight minutes more time to reach the earth, when the earth and Jupiter are on *opposite sides* of the sun, than when they are both on *the same side* of it. These eight minutes are the time required by the light to travel across the earth's orbit, and as this orbit is 180 millions of miles in diameter, you may find, by an easy calculation, that the velocity of light through space is about 192,000 miles a second. You now see the reason why the flash of a gun reaches you before its report, a subject to which I have drawn your attention in the article on Sound.

Like sound, also, light is *reflected.* All bodies reflect light, but rough bodies scatter it irregularly in all directions. Smooth bodies, such as glass, polished metal, or the surface of tranquil water, reflect it in one certain direction. The law of reflection will be understood from Fig. 1. Let R E be a section of the reflecting surface, say a piece of looking-glass; and let the line A B be perpendicular to the surface. A beam of light falling upon the surface along the line A B will be reflected back along the same line. But if the beam of light fall *obliquely* upon R E, like L B, it will be reflected obliquely along the line B L′; and it will be so reflected as to make the angle at i equal to the angle at r. The former of these angles is called the angle of incidence, and the latter the angle of reflection. Those of you who know a little of Euclid will, I am sure, be able to prove that the beam of light falling from L upon B, and reflected from B to L′, pursues the shortest path possible. If you can get into a darkened room, into which a sunbeam enters through a small aperture, and try to verify this law for yourselves with a bit of looking-glass, you will be able, I am sure, to obtain a very solid knowledge of the reflection of light.

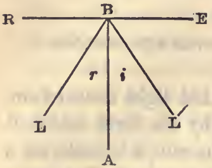


FIG. 1.

SECT. 2. Let us now apply the law of reflection in one or two instances. Suppose that a lady wished for a looking-glass in which she should be able to see her entire figure, and that she asked you how high the looking-glass must be to enable her to do this, what would be your reply? I daresay you would, on the spur of the moment, say that the glass must be as high as the lady; but if she acted on this advice she would be put to very unnecessary expense. Let us try to get at the truth. Let the line A B (Fig. 2) represent the height of the lady, and let R F be a looking-glass of the same height. The light from the lady's eye at A, which strikes the looking-glass *perpendicularly* at R, is reflected back along the same line, and the lady sees the image of her eye at A′ just as far behind the looking-glass as the real eye is before it. The light from the lady's foot at B reaches the eye by first striking the looking-glass

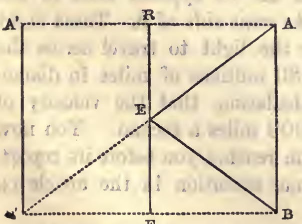


FIG. 2.

at E, exactly midway between R and F, and then, being reflected along the line E A, the lady sees her foot in the direction of this last line, the image of the foot appearing at B′, just as far behind the looking-glass as the real foot is before it. Now, it is plain that the whole of the mirror from E downwards is perfectly useless, and that the lady may dispense with this portion, and see her full figure in a looking-glass which is only half her height.

It is easy to see that by reflection we can alter the direction of a ray of light just as we please; and that by means of reflectors suitably disposed we can see round corners, and over walls or houses far higher than we are ourselves. At the siege of Sebastopol, when a gun was fired, the English sailors could not resist the temptation of peeping over their defences to see the effect of the shot. They thus exposed themselves to the Russian riflemen, and many of them were picked off. A friend of mine devised the following simple arrangement to enable them to indulge their curiosity without endangering their lives:—

A B (Fig. 3) is a square wooden tube about 18 inches long; a, near the end of the tube, is a hole in the side, and a', at the other end, a similar hole. The line m n represents a bit of looking-glass placed across the tube as in the figure, and m' n' is a second piece of looking-glass placed in a similar manner. Now, let D be the embankment or parapet, behind which the sailors are concealed. By placing the tube as in the figure the light from the Russians would enter the tube along the line R o, be reflected downwards to o', and thence again to the eye of the observer placed at E, who would see all that was going on. In this way the operations of an enemy might be watched without any exposure whatever on the part of those watching them. I sometimes meet an old man in one of the London parks

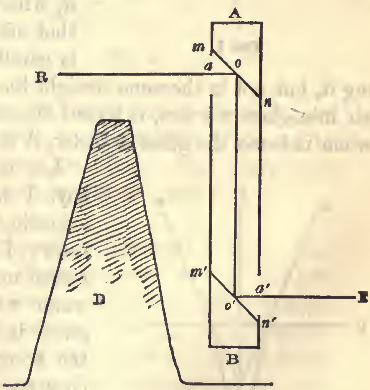


FIG. 3.

with an instrument founded upon these principles. He extracts a great deal of money from ignorant people by making them believe that the instrument enables them to see *through* deal-boards or through each other's bodies.

SECT. 3. I have thus far spoken of the *reflection* of light, I want now to speak of its *refraction*. Let M N (Fig. 4) be the section of a plate or of a glass of water, with parallel surfaces, and let A B be a beam of light which falls *perpendicularly* upon the surface of the plate. A portion of this beam is reflected, but a portion goes straight through the transparent plate to C without deviating to the right or to the left. But if a beam, like A′ B, fall *obliquely* on the plate, it does not pursue a straight course, which is that marked by the dotted line; but it is bent or *refracted* at B, passes on to *d*, where it is refracted back again, so that after leaving the plate its course is parallel to its course before entering it, but not in the same straight line. When the ray *enters* from air into glass or water, it is bent *towards* the perpendicular A C; and when it *leaves* the glass or water, it is bent *from* the perpendicular.

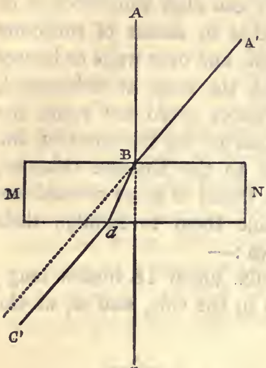


FIG. 4.

Let us apply this law. When a boy, I have often made a mistake regarding the depth of water, and before I could swim I sometimes placed myself in danger by going into water which was deeper than I imagined it to be. Let A B (Fig. 5) be the bottom, and C D the surface of a clear river or lake, and let *p* be a point, say a pebble, at the bottom. Let us suppose a boy's eye placed above the surface about E. The ray from *p*, which ascends directly upwards so as to cut the surface at right angles, reaches the eye without any

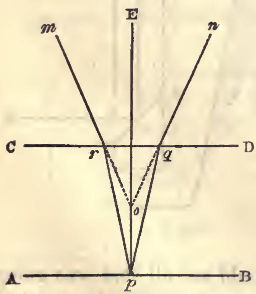


FIG. 5.

refraction, but no other ray from the pebble does this. Take, for example, the rays $p\ q$, $p\ r$, at both sides of the perpendicular; when they reach the surface they are bent at the points q and r away from the perpendicular. Now, the eye above the water takes no notice of this bending. It sees the object from which the rays come *in the direction in which the rays enter the eye*, and if we produce the rays $p\ m$, $q\ n$, backward, their point of intersection, o, is the point at which the pebble really appears to rest. To the eye the rays appear to proceed from this point. Thus, not only is a single pebble, but the whole bottom of the river raised, so as to make the water appear much more shallow than it really is.

If, instead of looking straight down through the water, you look obliquely, the bottom will appear to be raised; and now you will have no difficulty in understanding the following very pretty and very common experiment. A B (Fig. 6) is a basin, and C is a piece of coin placed at the bottom of it. Let the eye be placed at E, so that the edge of the basin shall cut off the view of the coin. Now fill the basin with water; in consequence of the refraction which I have just explained, its whole bottom will be apparently raised, say to the level A B, and the coin will come into view. This experiment is very easily made, and I would advise you to make it.

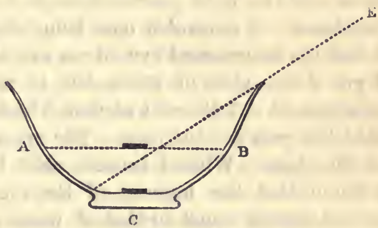


FIG. 6.

SECT. 4. Light passes freely through transparent bodies. Air is transparent, and so is water. Have you ever asked yourselves how it is that a mixture of air and water, as in foam, or in vapour, or in the clouds, can so completely intercept the light? The reason is exactly the same as that given for the enfeebling of the sound of the Orinoco Falls, to which I have already adverted. In passing from one transparent substance to another of different refrangibility, a portion of light is always *reflected*. Now foam is an intimate mixture of air and water. The light which strikes the foam passes incessantly from air to water, and from water to air; at each passage a portion of the light is reflected, and the process is repeated so often as at last to cut off the light altogether. If you pound any transparent solid to powder, the little grains taken separately will be transparent, but heaped together they are mixed with air, and the powder is consequently white and opaque. This is the reason why common salt and pounded glass are white and opaque; the effect is wholly due to the repeated reflection of the light at the limiting surfaces of the solid, and the air contained between its grains.

I have said that this is the case with substances having different refrangibility, or which, in other words, possess different powers of bending the rays of light. Air possesses this power, but glass, or salt, or water, possesses it in a much higher degree, and hence the effect of their mixture. But if two transparent substances possess *the same* refrangibility, there is no reflection at their joining surfaces, and the light passes through both, as if it were a single substance. I remember once being startled by the following fact. I had the transparent eye of an ox, which I wished to preserve; I put it in a glass of water, but, to my astonishment, it at once disappeared. I thought at first it had suddenly melted, but found that this was not the case. The eye was quite safe at the bottom of the glass. When I became older I learned the cause of this; I found that the humour of the eye possessed a refrangibility almost exactly equal to that of water; the consequence was, that there was hardly any reflection from the limiting surfaces of both, and hence no means of seeing the eye.

Now what must the effect be if you take a white pervious body, the opaqueness of which is due to the air mixed up with it, and insinuate into its pores a liquid possessing a refrangibility equal, or nearly equal, to itself? You would thereby expel the air, destroy, or greatly diminish, the repeated internal reflection, and make the substance more transparent. This is the entire philosophy of the transparent paper used by engineers and surveyors. The paper fibres are semi-transparent, but air exists in the pores of the paper, and to this its whiteness and opaqueness are due. If we dip the paper in spirits of turpentine, the liquid fills the pores, driving out the air. The turpentine has nearly the same refrangibility as the paper fibres, and hence its effect is to render the paper transparent. The darkness of spots of grease on paper, or on linen, and the darkened colour of a white towel when you dip it into water, are due to the same cause. How beautiful and interesting these common facts appear when they are properly understood!

SECT. 5. If time permitted, I should like very much to talk to you about the eye, and to explain to you the manner in which it acts upon light. You know what the pupil of the eye is. When you look at a very small dot, a cone of rays, the base of which is the pupil, and the point of which is the dot, enters the eye. Well, the eye has it in its power to squeeze these rays so together that they shall form a little dot upon a screen at the back of the eye, exactly the same as the dot at which you are looking and from which the rays come. This screen is a network, formed by the optic nerve, and is called the *retina*. Not only is this the case with a single point, but when you look at a man, or at a town, or at an extensive landscape, the eye possesses the power of rebuilding, out of the rays proceeding from these objects, an exact image of them upon the retina. And if you could look at the back of your neighbour's eye when he sees a horse, or a house, or a tree, you would see painted upon his retina an image of the house, or horse, or tree. It is in this way that the nerve receives intelligence of the world without, and this intelligence it afterwards transmits to the brain. With regard to the image upon the retina, the following is known, or believed, to take place. When the image of a strongly illuminated body falls upon the retina, the image encroaches a little beyond its proper limits, because of the intensity of its light. And the object from which the light comes appears, on this account, to be *larger* than it really is. This effect is called *irradiation.* Standing at a sufficient distance from a piece of wire brought to a white heat by an electric current, the wire, which in reality may not be thicker than a hair, will appear thicker than a goose quill. You have heard, I have no doubt, of the old moon in the new moon's arms : you have seen the new moon embracing the dim sphere of the satellite, and appearing to be part of a larger sphere! This is due to irradiation, which makes the illuminated rim of the moon appear larger than it really is. Another point to be noticed is the *time* which a luminous impression remains upon the eye. I have already spoken of the time required for an excitement of the nerve of hearing to subside. Now the impression of an instantaneous luminous flash remains upon the retina for about the tenth of a second; so that if the eye receives say twenty flashes per second, although these flashes might be really distinct, still the source from which they emanated would appear as a constant light. I have made an experiment in which a flame is quenched and re-lighted fifty or one hundred times in a second; but to the eye the flame appears to burn with a constant light. If a luminous point describe a circle in less than the tenth of a second, it will have reached its starting-point before the impression made at the commencement is extinguished, and the circle will appear as a luminous line; every boy has made this experiment with the burning end of a stick. What you are to remember here is, that the circle of light is due to the time required for an impression once made upon the retina to subside. The flash of lightning is almost instantaneous; but its impression remains for a time upon the eye; and if a cannon ball, flying at its fullest speed through the air, were illuminated by such a flash, it would appear to stand still for the tenth of a second at the place where the flash struck it.

SECT. 6. I must now say a few words about *colours*. I have already explained how a ray of light is refracted. Pieces of glass may be cut in such a manner that the refraction, or bending, produced by them shall be very great. If a beam of common sunlight be bent in this way we are made acquainted with the astonishing fact that some portions of such a beam are more refracted than others; we separate the ray into the parts which compose it, and we find that the different parts produce the impression of colours of great splendour. We find that the part which is most refracted is the violet portion of the beam, while the part that is least refracted is the red portion. Between these two limits the other colours lie in the following order:—After red comes orange, then yellow, green, blue, indigo, and violet; every colour shading gradually off into those next it. By properly mixing these seven colours together we obtain the common white light. In some cases the mixture of two colours produces white, and these are called complementary colours. Yellow light and blue light, when properly mixed, produce white light. This may appear strange to you, for most people imagine that yellow and blue produce green. This error has arisen by making experiments with yellow and blue powders or paints, instead of with pure yellow and blue light. The mixture of the powders produces green, but the mixture of the lights produces *white*.

All the colours in the world, whether of clouds, or fields, or flowers, are the consequence of this property of the light. A red rose has the power of extinguishing, more or less, all colours except red, and sending it in large proportion to the eye; but a red rose could not appear red if the light which fell upon it did not contain this colour. The flame of alcohol and salt is pure yellow, and when a rose is illuminated by this light it loses its bloom; red lips and red cheeks also fade away, and leave their possessor a ghastly complexion.

I may remark here, that some eyes are incapable of distinguishing certain colours, and a most interesting book on this subject has been written by Dr. George Wilson of Edinburgh, which would amuse and instruct you. Some people cannot distinguish the colour of red cherries on a tree from the surrounding green leaves. A piece of red cloth placed upon a donkey's back appears to some to be of precisely the same colour as the donkey; and it is said of one very grave gentleman, who wished to purchase some quiet drab clothes, that he furnished himself with scarlet. I have a friend who cannot distinguish the scarlet flowers of the geranium from the surrounding leaves; and to him the ruddy cheeks of his little son are of a bluish green.

Sect. 7. There is one other point concerning which I should not like to leave you quite ignorant, though the subject is usually considered far too difficult to be introduced to the notice of boys. If you turn to the article on Sound, you will learn that in the production and perception of musical sounds three things come into play. We have, first, a vibrating body; secondly, the air to which the body communicates its vibrations; and thirdly, the auditory nerve, which receives the impulses from the air, and transmits them to the brain. We *know* all this. Now, with regard to it there are certain things which are *believed*, though we cannot be said to *know* them. Almost all scientific men, at the present day, believe that the particles of a luminous body are in a state of vibration; we believe that these vibrations are communicated, not to the air, but to something finer than air, which philosophers call *ether*. The impulses thus excited are communicated through the transparent media of the eye, and striking upon the retina or optic nerve at the back of the eye, produce the impression of light, just as the impulses of the air striking upon the auditory nerve produce the impression of sound.

Still more, we believe that we know with the utmost exactitude the *lengths* of the little waves of ether, and the *number of impulses* per second which produce the impression of any particular colour. We believe that colour depends solely upon the number of impulses received by the retina per second. We believe that to produce the impression of the colour blue requires a greater number of impulses per second than that necessary to produce the impression of red. In fact, when you say "I see the colour red," it is another way of saying, "My eye, at the present moment, is in receipt of 470 millions of millions of impulses." While, if you say "I see blue light," it is another way of saying, "My eye is now in receipt of 700 millions of millions of impulses per second." You see, then, that *blue bears the same relation to red that a high note does to a low one.* In fact, from red to violet, the notes, if I may be allowed the expression, go on gradually increasing in pitch. Remember, we have never seen those waves, we have never felt these vibrations as such, still we firmly believe in their existence. Man is gifted with powers which enable him to prolong his vision beyond the boundary of his senses, and to see things with the eye of his mind, which are too fine for his bodily organs to perceive.

HEAT.

CONDUCTION AND RADIATION—DEW.

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

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

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

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

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

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

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

SECT. 3. Now, take the case of a meadow spread out under a clear and cloudless sky. During the day the sunbeams falling upon the grass warm it and the air about it, thus keeping the vapour in an invisible condition. But when the sun sinks below the horizon, what takes place? The grass is an excellent radiator; overhead is pure space, nothing to intercept the heat radiated from the grass; nothing to give the grass anything in exchange for what it loses. True, the earth beneath the grass is, to some extent, warm, but the grass is a very bad conductor, and cannot make good its loss from this source. The grass blades consequently become more and more chilled, and this cooling is sometimes so great, that a thermometer placed upon the grass is observed to be fifteen or twenty degrees lower than one suspended in the air a couple of feet above the surface of the meadow. What must be the consequence here? Why, the cooled grass blades act the part of the tumbler filled with ice-cold water to which I have already alluded. They condense the surrounding vapour upon their surfaces, and in the morning we find the vapour thus precipitated formed into dew-drops as beautiful as pearls, nay, far more beautiful to the mind which can follow with intelligent admiration the operation of the laws by which the result is produced. If the night be a clear one in winter, the process does not stop here; the cooling continues until the precipitated vapour is converted into hoar frost.

The quantity of vapour in the air is very different at different times. To have a plentiful deposit of dew, we require three conditions. A good quantity of vapour in the air, calm weather, and a clear sky. If the weather be windy, the comparatively warm air above the meadow is incessantly mixed with the grass, and prevents its being chilled. If the sky be cloudy, the heat radiated by the grass is intercepted by the clouds and sent back again, the system of exchanges before described being established. Nay, it is observed that when clouds suddenly form, and throw themselves like vast screens across the canopy of heaven, the temperature of a thermometer placed on the grass rises, and the formation of dew is instantly checked. What grand conceptions the formation of a single dew-drop carries along with it; and how noble is the knowledge which makes us sharers in the methods by which Nature accomplishes her ends!

Before quitting this subject, I should like to say a few words about the influence of *colour* upon the radiation and absorption of heat. Let me first explain this last term: it is found that bodies which radiate heat freely, also absorb heat freely. A polished teapot, and one coated with chalk, lampblack, or even transparent varnish, being filled with cold water and placed at some distance from a fire, the water in the coated pot will heat much more rapidly than that in the uncoated one. The reason is, that the coating in each case is a good absorber, as it is also a good radiator, whereas the feebly radiating metal has also a feeble power of absorption. With regard to colour it is certainly true, that if two pieces of cloth of the same texture, the one of which is black and the other white, be exposed to the sunbeams, the black is heated most quickly and intensely. But this is only true of *luminous heat*, such as that of the sun. If a black cloth and a white cloth be held before a vessel which contains boiling water, the heat emanating from such a vessel, from the surface of a locomotive for example, is absorbed just as well by the white as by the black. In the same way, if the white and the black be both warmed, and then permitted to radiate their heat into space, the one radiates it just as quickly as the other. *Colour has no sensible influence on the radiation or absorption of obscure heat.* The whiteness of the fur of polar animals has been supposed to protect them from rays of heat by radiation. There is no scientific ground for this opinion. The whitest Englishman and the blackest Ethiopian radiate heat with equal facility; for the heat which they radiate is *obscure heat*, upon which colour has no influence. While, then, white dresses and white hats are suitable defences against the heat of the solar beams, we must not suppose that they protect us from loss by radiation, or defend us in the least against the radiation of heat from non-luminous sources.

If you expose water in a basin, it slowly evaporates; the water escapes in the form of vapour into the air. If you heat a vessel containing water, the liquid finally boils. Let us inquire, like philosophers, what is the meaning of the boiling of water. The youngest boy who reads this page knows when the water in a saucepan is boiling—how does he know it? By the *bubbling* which he observes. Bladders of steam are formed at the side of the vessel, which rise to the top of the liquid, and throw it into a state of commotion. Each of these bubbles is covered by a thin film of water, so fragile that the slightest touch is sufficient to break the film. Now you know that the atmosphere presses upon each square inch of the earth's surface with a weight of 15 lbs. You know that each one of us bears an enormous load of air; and each of the little bubbles which float upon the surface of a boiling liquid bears its share of the weight of the atmosphere. A bubble having a surface of half a square inch, which would not be a very large bubble, bears a pressure of seven pounds and a half. Why is it not crushed by this pressure? How can that frail thing, which is unable to support the shock of a falling feather, support a weight of seven pounds and a half? The reason is, that the steam within the bubble possesses an elastic force exactly equal to the pressure of the atmosphere. The film is caught between two elastic springs, which press with exactly equal force in opposite directions. The pressure *of the air* prevents the bubble from being *torn asunder* by the vapour within it, and the pressure *of the steam* prevents the bubble from being *crushed together* by the weight of the atmosphere without it. This then is the real definition of the boiling point of a liquid—it is that temperature at which the vapour of the liquid has a tension, or an elastic force, for these terms are used indiscriminately, equal to the pressure of the atmosphere. On this condition alone is the existence of the bubbles which indicate boiling possible.

Volatile liquids require a comparatively small amount of heat to bring their vapour to a tension sufficient to cope with the pressure of the atmosphere. Water boils at 212°, alcohol at 173°, ether at 97° Fahrenheit; while mercury, a liquid metal, requires a temperature of 660° Fahrenheit to cause it to boil. Now, reflect a moment: suppose by any means we lessen the atmospheric pressure upon the surface of a liquid, the vapour of such a liquid, when it boils, will have a tension only equal to the diminished atmospheric pressure. To produce such vapour, therefore, less heat is required; or, in other words, the boiling point of the liquid is lowered when we lessen the pressure upon its surface. This is found to be the case. Let a vessel of water which has been removed from the fire, and has ceased to boil for several minutes, be placed under the receiver of an air-pump, the heat possessed by the water can produce vapour of a certain tension; and when the pressure of the air in the receiver is so far diminished as to make it equal to this tension, the liquid will boil. A vessel of alcohol, at the common temperature of the air, will boil violently under the exhausted receiver of an air-pump. And if you take a vessel of water up to the summit of Mont Blanc, and boil it there, you will find that the boiling temperature is less than at the level of the sea, because the weight of air is less which the liquid has to bear. In fact, you could not make a comfortable cup of tea, nor a good basin of soup, with the water boiled upon the summit of Mont Blanc; for boiling water there is not hot enough for these purposes.

In like manner also, if we increase the pressure upon the surface of a liquid, we require a greater amount of heat to cause it to boil. Thus, in walking down a mountain, we find the boiling point rise higher and higher as we descend, simply because the weight of air pressing upon the liquid becomes gradually greater. You have heard of the geysers, or boiling springs of Iceland. The great geyser has a tube 74 feet deep; it is usually filled with hot water, and at the bottom of the tube the water often reaches a temperature of 260° Fahrenheit, without boiling. The reason is, that the water here has to bear not only the pressure of the atmosphere, but also the weight of a liquid column 74 feet high.

Let me here endeavour, in a few words, to give you an idea of the cause of the eruptions of this wonderful spring. The tube is 10 feet wide, and is surmounted by a basin about 60 feet across. Both tube and basin are coated by a smooth hard plaster deposited by the spring itself; indeed, it is the spring that has built the tube and formed the basin at its head. Before an eruption takes place, explosions are heard underneath the earth, and the water in the basin becomes violently agitated. These explosions are produced by the rush of steam from channels in the hot rocks into the tube of the geyser, where it is condensed to water. Every rush of steam, however, lifts the geyser column, and produces the commotion observed in the basin. This goes on until the water in the geyser tube approaches its boiling point; that is to say, the temperature at which it can boil under its own pressure, added to that of the atmosphere. Suppose, then, that it has reached a temperature very near its boiling point, and that a mass of steam then rushes in from the channels which communicate with the tube, the column is lifted up, and the water overflows the basin. The pressure upon the lower parts of the column is thereby diminished. Under the diminished pressure the water near the bottom of the column *can boil*—it does so suddenly, and discharges the mass of water above it with explosive violence into the atmosphere. Some of these eruptions attain a height of 150 feet and more. The whole effect, you see, is a consequence of the laws which we have been considering.

SECT. 5. Would you not suppose that if a metallic vessel be made red-hot, and water be poured into it, that the water would suddenly be thrown into a state of violent ebullition? This, how ever, is not the case. A drop of water let fall into such a vessel rolls about like a raindrop upon the surface of a cabbage leaf, and evaporates very slowly. The reason is, that when the drop of water approaches near to the red-hot surface, it darts out a quantity of vapour of sufficient tension to bear the weight of the drop.

The drop then rolls about upon a cushion of its own vapour, and does not come into contact with the heated metal at all. If the metallic vessel be allowed to cool gradually, a point soon arrives when the vapour is no longer of sufficient tension to support the drop. The water then comes into contact with the metal, and violent ebullition is the consequence. Thus you see how the vapour, as long as it has sufficient tension, forms a protecting layer round the drop. Have you ever seen a blacksmith lick a piece of white-hot iron? It can be done without suffering the slightest inconvenience. The tongue does not come into contact with the iron at all, the moisture forms a layer of vapour which protects the tongue. I have seen a gentleman pass his moistened hand through a stream of molten iron as it flowed from a furnace, and I have often dipped my own fingers into molten lead. The hotter the lead is the better, for the more certain you are that the vapour will possess a tension sufficient to protect you. Before making the experiment, it is well to moisten the fingers; of course it would be unwise to have the fingers immersed for more than an instant in the molten mass. Many wonderful escapes from the fiery ordeal of ancient days may be accounted for in this way.

The following remarkable experiment depends also upon the protective influence exercised by a layer of vapour. It is possible to obtain the gas which you see bubbling from soda water, that is to say, carbonic acid gas, in a *solid* condition, as white as snow. The cold of such solid carbonic acid is intense; and if we pour a little ether on the substance the cold becomes far more intense still. If a mixture of the carbonic acid and ether be placed in a red-hot crucible, a layer of vapour is developed around the mixture, which not only protects it from becoming intensely heated, but enables it to remain intensely cold in the red-hot vessel. If a spoon containing water be plunged into the mixture the water freezes instantly. The same occurs when a capsule containing mercury is dipped into the red-hot vessel. The mercury solidifies with extreme quickness, and when removed from the vessel it may be cut with a knife.

Sect. 6. Let me just say a few words on an effect of heat which is sure often to attract your attention in life: I mean its power of causing bodies to expand. Different bodies expand differently by heat; lead, for example, expands far more than iron, and some crystalline bodies expand differently in different directions. This force of expansion is almost irresistible; indeed, the contraction of iron bars by cooling has been applied to pull the massive walls of large edifices closer together. Bodies, then, contract by cooling, but water and some other substances form, under certain circumstances, an apparent exception to this rule. Water continues to contract by cooling until it reaches a temperature of 39° Fahrenheit; the contraction then ceases, and it commences slowly to expand. When it reaches the temperature of 32° Fahrenheit it freezes, and the passage of the substance from the liquid to the solid condition is accompanied by a *sudden increase of volume.* The particles in the solid state require more room than in the liquid state. The force of expansion here is enormous. If the water be enclosed in the stoutest bomb-shell, it will burst the shell in freezing. This is the cause of the bursting of leaden pipes by frost; when the thaw comes, the injury done by the act of freezing becomes first manifest. From what has been said you will see that ice is lighter than water, bulk for bulk, and hence it is that ice swims on water. The metal bismuth is another substance which exhibits, in a striking manner, this increase of volume on cooling. I have filled a strong iron bottle with the molten metal, and closed it by a screw-tap; on cooling, the metal expanded, and rent from top to bottom the iron vessel which contained it.

ELECTRICITY.

POSITIVE AND NEGATIVE ELECTRICITY—THUNDER AND LIGHTNING—THE ELECTRIC TELEGRAPH.

SECT. 1. In order to repeat for yourselves the little experiments which I am now about to describe, I would recommend you to get two small sticks of sealing-wax, two pieces of glass tube, a piece of flannel, and a piece of silk. In all experiments, the wax, the glass, the flannel, and the silk, must be perfectly dry.

If you rub the stick of sealing-wax with the flannel, or against the cloth sleeve of your coat, and if you rub the glass with the bit of dry silk, you will find that the wax and the glass have acquired by the rubbing the power of attracting very small bits of paper or other light bodies. This effect was first observed with rubbed amber, which the Greeks called *electron;* and this is the reason why we call the force or agent which produces the attraction *electricity.*

The experiment which I have just described, though usually the first made, is by no means the most simple. We must know a good deal of the laws of electric action before we can explain the attraction of the bits of paper; and these laws I will now endeavour to make plain to you.

You must try and construct a little paper or wire loop, in which you can lay your bit of glass tubing, or your stick of sealing-wax, so as to suspend it horizontally by means of a fine string. In Fig. 1, I have sketched such an arrangement, where A B is supposed to be the stick of wax laid upon a loop of wire.

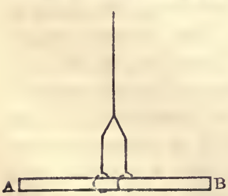


FIG. 1.

Rub one stick of wax with the flannel, and place it on the wire, taking care that the surface of the wax is not scraped by the wire. Now, rub the second stick of wax, and bring its end gradually near to the end of the suspended stick. You will find that the suspended stick will be *repelled.*

Remove the sealing-wax, and put a piece of glass tube rubbed with silk in its place; rub the second glass tube with silk, and bring it near to the suspended one; you will find, in this case also, that *repulsion* will take place. Thus we see that rubbed wax repels rubbed wax, and rubbed glass repels rubbed glass.

Let the rubbed glass remain on the loop, and cause the rubbed wax to approach it, you will now find that the wax is *attracted* by the glass.

Let the rubbed wax be placed on the loop, and the rubbed glass brought near, you will find that the rubbed wax *attracts* the rubbed glass.

Instead of the wax, I might choose from a great number of other resinous substances, amber, rosin, sulphur, gutta-percha, shellac, &c.; and instead of the glass, I might choose from a great number of vitreous bodies, crystals and stones of various kinds. On submitting the substances to the experiment just described, we should always find that the resinous bodies, when rubbed, repel each other, and that the vitreous bodies, when rubbed, repel each other; but that the rubbed resinous body attracts, and is attracted by, the rubbed vitreous body.

For the sake of making you understand me more clearly, I must now place an image before your mind. You often hear of the electric fluid. Some people believe in such a fluid: I confess to you that I do not; but still the conception of a fluid will be extremely useful in helping you to understand me.

It has been imagined that, by the act of rubbing, a thin layer of this fluid is diffused over the glass or over the sealing-wax. That diffused over the glass has been called *vitreous* electricity, and that upon the wax has been called *resinous* electricity. The former is also often called *positive* electricity, and the latter *negative* electricity. Indeed, the two last terms are the most common, and I shall make frequent use of them.

Remembering, then, the experiments which have been just described, we arrive at the fundamental law of electric action, which is usually thus expressed: *Electricities of the same name repel each other, and electricities of opposite names attract each other;* positive *repels* positive, and negative *repels* negative, but positive and negative *attract* each other.

SECT. 2. Some bodies permit this electric fluid to pass over them with great facility; such bodies are called *conductors* of electricity. The metals are all good conductors. Other bodies hold the fluid fast upon their surface, and do not permit it to pass freely over them; such bodies are called *non-conductors,* and sometimes *insulators.* Resinous bodies are all non-conductors.

If you rub a rod of metal held in the hand, and examine it afterwards as we examined the wax and the glass, you find no trace of electricity upon it. Electricity, however, is developed on the metal, but it flows instantly away through the hand to the earth, and leaves no trace behind.

But fix your rod of metal on a shellac, or a sulphur, or a gutta-percha handle, and take this in your hand while you rub the metal. The fluid cannot now escape over the insulator, and on examining the metal rod you will find that it can attract light bodies, and behave in other respects like the glass or the sealing-wax.

Lay a quill, or a bit of wood, upon the wire-loop, Fig. 1. It will be attracted by either the rubbed glass or the rubbed wax. Let it strike against either of them, or rub either of them carefully against the wood or quill, you thus transfer a portion of the electricity of the glass or the wax to the suspended object; and if you make the experiment properly, you will afterwards find that the object is repelled by the body which has given it the electricity. This is what you would expect from the law already mentioned.

But why is the wood attracted without being rubbed? Why are the small pieces of paper attracted in the experiment referred to at the commencement of this article? These are difficult questions, and you must listen attentively.

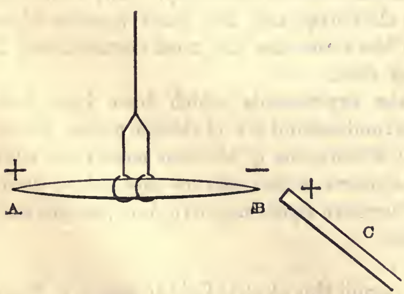


FIG. 2.

I have shown you that there are two electric fluids; or, at least, I have asked you to picture such to your minds. Now these two fluids exist in all bodies, but they exist mixed together, the one thus neutralizing the other.

Let A B (Fig. 2) be the piece of light wood placed upon the wire loop, and let C be a piece of glass tubing rubbed with silk, so as to have positive electricity on its surface. I use the sign + to denote the presence of this positive electricity. The action of this electricity upon the *mixed electricities* of the wood is the following :—The positive of the glass repels the positive of the wood, and drives it to the furthest end of the little beam. It attracts the negative of the wood towards itself. At B, therefore, we have negative electricity, and at the adjacent end of C positive electricity. These attract each other, and pull the matter with which they are associated along with them. Hence it is that the unrubbed wood is attracted by the rubbed glass. This separation of the mixed electricity by an electrified body is called *induction.*

Further, touch the end A of the little beam with your finger, the positive electricity flows through your hand to the earth, and the negative alone remains, held fast by the attraction of C. Remove the rod C; if what we have been saying is correct, we ought to have negative electricity left behind on the surface of the beam. This is the case; and if you take a piece of rubbed sealing-wax and operate cautiously, you will find the beam repelled by the wax. If you touch the beam so as to allow the negative electricity, which is now free, to pass away, you will find no trace of repulsion more; the wood is now invariably attracted by the wax.

If you substitute for the glass tube C a stick of rubbed sealing-wax, the mixed electricity of the wood will also be separated, but the positive will be drawn towards the wax, and the proximity of the unlike electricity will produce attraction, as in the former case.

If two bodies be electrified very intensely and oppositely, when they come near each other the attraction becomes so strong that the electric fluids spring towards each other across the layer of air which separates them. Their passage is accompanied by a spark and a little crack. When large quantities of electricity are collected and discharged, the spark becomes large and brilliant, and the crack becomes loud.

SECT. 3. We are now in a condition to understand something of what is called *atmospheric electricity*, the electricity that produces the lightning flash and the thunder peal. In the processes of vegetation and evaporation; in the action of winds sweeping over the earth's surface; and of opposing atmospheric currents sweeping past each other ;—in these, and perhaps in other actions still more potent, though less known to us, electricity is developed and diffused upon the clouds as it is developed and diffused upon the glass by the friction of silk.

Supposing two clouds both positively electrified, or both negatively electrified, to come near each other, the experiments we have already made enable us to tell what their mutual action will be. There will be here no sweeping of the electricity of one cloud to meet, in hot embrace, that of the other. Like electricities repel each other ; and two such clouds, instead of coming together by mutual attraction, would be driven asunder by their mutual repulsion.

But suppose one cloud charged positively, and the other charged negatively : here we have a magazine of power which it would be difficult to collect by our experiments. The clouds approach, and when they come sufficiently near,—when the layer of air which throws a resisting obstacle between the electricities of both clouds is sufficiently reduced in thickness, this resistance, being no longer able to contend against the intense attraction of the two electricities, these break through the air in a flash of lightning, and the crackle which we heard in our tiny experiments is augmented to a peal of thunder.

Or suppose an electrified cloud to approach one that is unelectrified ; that is to say, one in which the two electricities are so mixed together as to neutralize each other. The electrified cloud separates these fluids, as in the case of our little wooden beam ; it draws the opposite electricity towards itself, and when the clouds come sufficiently near to each other, the attracting fluids spring together across the resistant air, producing the same effect as if one cloud was electrified positively and the other negatively.

If the discharge of atmospheric electricity always confined itself thus to the clouds, it need give us very little alarm ; but this is not the case. Suppose a cloud positively electrified to float over the earth's surface, the portion of the surface underneath the cloud takes up, by induction, the opposite electric condition to that of the cloud itself. If the cloud's surface be positive, the earth's surface will be negative. Should the cloud come near enough, what will be the consequence ? Why, the discharge passes between the earth and cloud just as between the two clouds in the case last supposed.

The discharge darts from a single point of the cloud's surface, and is met by the discharge from a single point of the earth's surface. These are the points at which the electric fluids attract each other with the greatest intensity. Suppose a man to stand beneath a thunder cloud, and that his head, being nearer to the cloud than the ground around him, is more intensely electrified than the ground; from his head the discharge from the earth will issue; his body is made the channel of the discharge, and his death is the consequence.

High objects, such as trees, steeples, and chimneys, are the most liable to be struck by lightning. They are the most intensely electrified by the inductive action of the clouds, and hence the discharge starts from them. To protect steeples and chimneys, lightning-conductors are made use of. Note this: it is only where the lightning meets *resistance* that it produces destructive effects. An iron house would not suffer in the least from lightning, because the metal being such a good conductor, the fluid passes quietly along it. But a stone house, or a tree, or the body of an animal, is not such a good conductor: here the electric fluid meets resistance, and destroys the body that resists it. Lightning-conductors are metallic rods, which reach higher than the buildings they protect, and are buried deeply in the earth. They become the channels of the electric discharge, which does not injure them; while it is diverted from the surrounding buildings which it would injure.

SECT. 4. Take a bit of clean zinc and lay it flat upon your tongue; take a bit of clean silver, a half-crown or a two-shilling-piece, for example, and place it *under* your tongue, so that a good portion of the tongue shall lie flat upon the silver. Now bring the outer ends of the metals into contact; the moment they touch each other you experience a peculiar hot sensation upon the surface of the tongue which is in contact with the zinc.

Take the same two pieces of metal and immerse them in water to which a little sulphuric acid has been added. As long as the metals do not touch each other you observe nothing remarkable.[1] Cause them to touch—bring their upper end, which may project beyond the liquid, as they projected beyond the tongue in the last experiment, into contact; the moment they touch you will observe

[1] The zinc ought to be amalgamated, otherwise it is attacked by the dilute acid before the metals come into contact.

bubbles arising from the surface of the silver, which cease to be formed the moment the contact is broken.

These bubbles are hydrogen gas. They are produced by the decomposition of the water, which, as you know, is composed of two substances, oxygen and hydrogen. The oxygen of the water is liberated on the plate of zinc, but it does not appear there in bubbles. It unites immediately with the zinc, forming oxide of zinc ; which, in its turn, unites with the sulphuric acid contained in the water, and forms sulphate of zinc. This decomposition is produced by the passage of a *current* of electricity through the liquid.

In fact, if you properly examined the ends of the metals, silver and zinc, which project above the liquid, before they are brought into contact, you would find that the end of the plate of zinc was negatively electric in respect to the end of the bit of silver. When they are brought into contact, the positive electricity flows across the junction from silver to zinc, the negative flows the other way, thus constituting a kind of *double current.* For the sake of simplicity, it has been agreed to call the direction in which the *positive* electricity flows *the direction of the current.* Thus, in the experiment just described, the direction of the current across the place of junction is from silver to zinc, it then passes down along the zinc, enters the liquid, and passes through the liquid from zinc to silver ; then up the silver to the place of junction, thus making a complete circuit.

Many scientific men firmly believe that all that I have here described actually takes place ; for my part, I wish only to make use of the idea of a current to make the matter more intelligible to you.

In the experiment with the tongue, an electric current is also excited, which decomposes in its passage the saliva of the tongue, just as the water is decomposed in the above experiment. It is the peculiar substances which are liberated at the surface of the zinc that cause the hot taste experienced when the metals are brought into contact. If the zinc be placed between the upper lip and the gum, while the silver remains under the tongue, on bringing the metals into contact, a flash of light passes before the eyes. The electric current, in this case, acts upon the nerve of the eye, and produces the impression of light. If a horse-leech or a little fish be placed between two plates of silver and zinc, or platinum and zinc, when the plates are caused to touch each other, the creature usually lets you know that it feels the effect of the current. Even a dead animal may be thrown into convulsions by the electric current. I have seen a pair of legs, which had been separated from the body of a skinned frog, leap a yard when a little arc formed of platinum and zinc wire was laid upon the nerve leading to the legs.

The electric current obtained in the way just described is excessively feeble, but by enlarging the metallic plates, increasing their number, combining them suitably together, and making use of the best liquids for the purpose, it is possible to get electric currents of great strength. Such currents affect the nerves, produce chemical decomposition, and excite heat, light, and magnetism in a very powerful manner.

Sect. 5. I want now to direct your attention to the action of an electric current upon a magnetic needle. Such a needle, when freely suspended, points nearly north and south: I must now ask you to suppose a wire, through which an electric current can be sent, to be laid *over* the needle, and parallel to it, without, however, touching it. The moment the current is established in the wire, the needle swings aside, and after a time comes to rest in a position more or less *oblique* to the wire. The tendency of the current is to set the needle at right angles to the wire, the tendency of the earth's magnetism is to set the needle parallel to the wire, the consequence is that the needle takes up an intermediate position. When the current is interrupted, the needle returns to the magnetic meridian.

I now require your attention. The direction in which the needle swings depends upon the direction in which the electric current flows. Supposing the direction of the current, in the case now supposed, to be from south to north, then the north end of the magnetic needle would be deflected *to the left.* If the direction of the current through the wire be from north to south, the north end of the needle will be deflected *to the right.* There are simple little instruments for reversing the direction of the current, and these place it in our power to move the north end of the needle to the right or to the left, just as we please.

It is possible to tell beforehand the direction in which a needle will swing when acted upon by a current; and it is also possible to tell, from the direction in which a needle swings, the direction of the current which acts upon it. I have no doubt of being able, by means of an image, to make this point clear to you. Imagine a little man to swim on the electric current in the direction in which it flows. Let his face be turned towards the needle, then the north pole of the needle will always be deflected in the direction of the little man's *left hand.* It was this very image that guided me when I stated the direction of the deflection in the last paragraph.

This rule holds good not only when the wire is *above* the needle, but when it is *below* it, or *beside* it. Following out the rule, you would find that if the current runs from south to north when the wire is *beside* the needle, the north pole would be *pressed downwards*, for the swimmers left hand would, in this case, point downwards. If the wire be *under* the needle, the swimmer, to turn his face to the latter, must swim *upon his back;* and hence, when the current flows from south to north, under the needle, the deflection of the north pole is the reverse of that produced when the current flows in the same direction above the needle.

This gives you, I trust, a general notion of the power we possess over the movements of a magnetic needle acted upon by an electric current. And you will easily conceive that we may make use of the deflections as signs, to which we may attach a particular meaning. A deflection towards the right may represent one letter or word, and a deflection towards the left another. By interrupting and re-establishing the current, we can make as many deflections as we please, and in any direction we please; and when we agree beforehand that certain deflections shall mean certain things, the possibility of conveying messages in this way becomes quite intelligible. The electric current travels through hundreds of miles of wire in an instant; an operator in Manchester or Edinburgh can deflect a needle in London, and then messages can be conveyed from both of these towns to London. The deflection of a needle has been hitherto made use of in this country for telegraphic purposes, but there are several other kinds of signs which may be made use of. To describe these would, however, require a whole book, and I shall be perfectly content if I have conveyed to you a clear notion of the possibility of an Electric Telegraph.

LESSONS ON THE HUMAN BODY.

INTRODUCTION.

THE human frame is composed of a series of systems interwoven together, each discharging its own function, and working together for the common good. 1. The *Bones* form a hard framework. 2. The *Joints* allow of motion. 3. The *Muscles* contract and perform the motions. 4. The *Nervous System* is the seat of sensation, regulates motion, and furnishes the instrument of intelligence. The remaining systems are for nourishment. 5. The *Digestive* system prepares the food. 6. The *Absorbent* system conveys it into the blood. And 7. The heart and blood-vessels circulate the blood to all parts of the body for its nourishment and renewal.

Man belongs to the higher or mammalian class of the great vertebrate division of the Animal Kingdom,[1] which includes fishes, reptiles, birds, and mammalians, and all are formed on the same general plan or type. The body, composed of the systems mentioned above, is divided into, first, the essential part, the trunk or body proper, including the head; and secondly, the limbs, which are merely locomotive appendages to the trunk, like oars to a boat. The vertebrate trunk is very simply planned, in the form of two canals, or cavities, and a central stem. It is divided into, or composed of, a series of segments or slices, termed vetebrate segments; each of which presents two rings and a solid centre; so that, when arranged longitudinally, the result is two canals and a central stem. The central stem is composed of the bodies of the vertebræ. The space behind is called the "neural[2] canal," from its lodging the great nervous centres, the brain and spinal cord. The space before is the "hæmal[3] canal," so called from its lodging the various organs connected with the formation of the blood from the food. This canal includes not only the stomach and chest, but also the

[1] See p. 37. [2] *Neuron*, a nerve. [3] *Haima*, blood.

face from the eyes downwards, the nose and mouth forming its double inlet. This is the great and simple idea of a vertebrate body.[1]

FIG. 1.

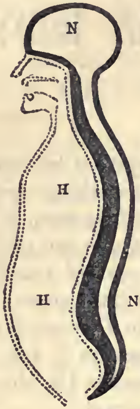
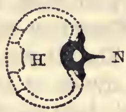


Fig. 1. Longitudinal section of the body, showing N N neural canal. H H hæmal canal.

Fig. 2. Transverse section of body, showing neural and hæmal rings, by the repetition of which the canals are made up.

FIG. 2.



The pupil is recommended to colour with red ink the narrow space between the dotted lines in Figs. 1 and 2. Fig. 1 is after Professor Henle of Göttingen. The other illustrations for this treatise, except Fig. 3 of the skeleton, are designed and sketched by the author.

PART I.

THE OSSEOUS, MUSCULAR, AND NERVOUS SYSTEMS.

THE OSSEOUS[2] SYSTEM.

BONES, by their hardness and strength, are useful in four ways. 1. They shut in and protect important and delicate parts, such as the brain, heart, and lungs. 2. They present levers for motion, serving as handles for the muscles to pull by. 3. They form columns of support. And 4. They serve generally, as a framework or scaffolding, to give form to the body.

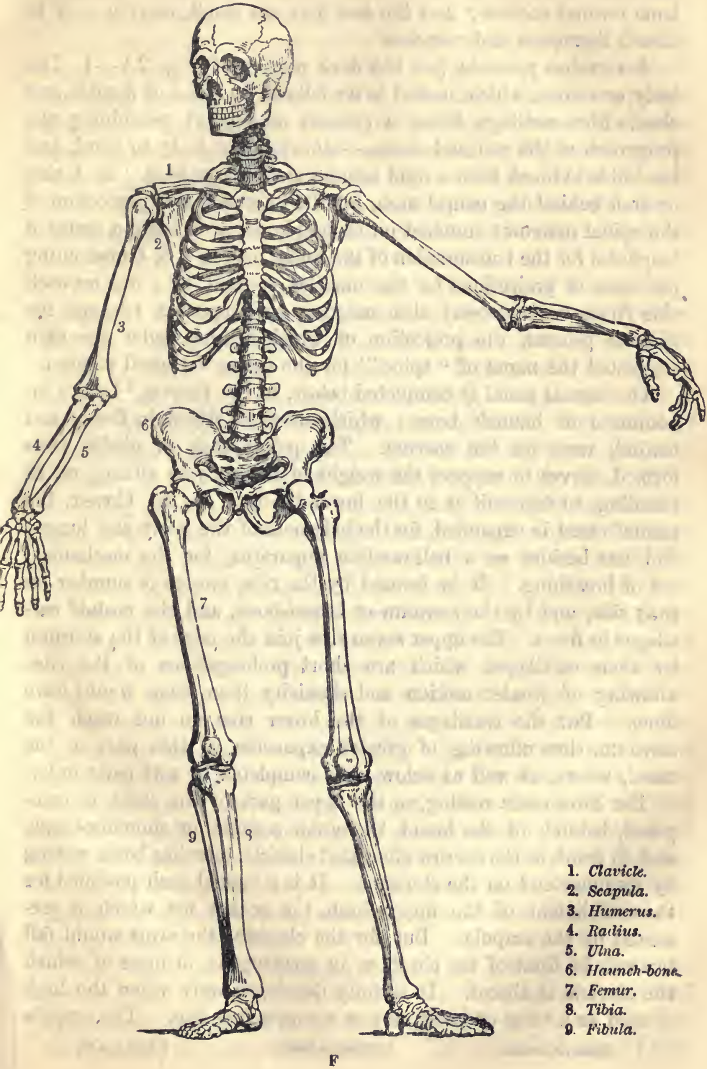
The SPINE, or back-bone, is composed of thirty-three pieces called vertebræ:[3] seven in the neck (cervical); twelve in the back (dorsal); and five in the loins (lumbar); of the remaining nine

[1] In reading this description of the bones, the pupil should make frequent reference to the figure of the skeleton.

[2] *Os*, a bone. Osteology, from *osteon*, a bone, and *logos*, a description.

[3] *Verto*, to turn. From their free motion on each other.

FIG. 3.



1. *Clavicle.*
2. *Scapula.*
3. *Humerus.*
4. *Radius.*
5. *Ulna.*
6. *Haunch-bone.*
7. *Femur.*
8. *Tibia.*
9. *Fibula.*

(pelvic), the next five unite together, in the adult, to form the bone termed *sacrum;* and the last four are small, serving only to attach ligaments and muscles.

A vertebra presents (see the dark portion of Fig. 2.)—1. The body or centre, which, united to its fellows by slices of flexible and elastic fibro-cartilage, forms a column of support, combining the properties of the rod and chain,—allowing the body to bend, and less liable to break than a rigid column would have been. 2. A ring or arch behind the neural arch, for the lodgment and protection of the spinal marrow; notched on each side, so as to leave a series of loopholes for the transmission of the spinal nerves. 3. Outstanding processes or projections for the muscles to pull by; one on each side (transverse process) also assisting to support a rib, and the spinous process, the projection of which behind under the skin suggested the name of "spine"[1] for the entire vertebral column.

The hæmal canal is completed below, at the PELVIS,[2] by the innominate or haunch bone; which meets its fellow in front, and behind, rests on the sacrum. The pelvic arch or girdle, thus formed, serves to support the weight of the body in sitting, or, in standing, to transmit it to the lower limbs. At the CHEST, the næmal canal is expanded, for the lodgment of the heart and lungs; and acts besides as a bellows-like apparatus, for the mechanical act of breathing. It is formed by the ribs, twelve in number on each side, and by the sternum or breast-bone, and the costal[3] cartilages in front. The upper seven ribs join the edge of the sternum by their cartilages, which are short prolongations of the ribs, allowing of greater motion and elasticity than bone would have done. But the cartilages of the lower ribs do not reach the sternum, thus allowing of greater expansion of this part of the canal, where, as well as below, it is completed by soft parts only.

The SHOULDER resting on the upper part of the chest is composed, behind, of the broad triangular scapula, or shoulder-blade, and, in front, of the narrow elongated clavicle, or collar-bone, resting by its inner end on the sternum. It is a hæmal arch modified for the attachment of the upper limb, the socket for which is presented by the scapula. But for the clavicle, the arms would fall inwards in front of the chest, as in quadrupeds, in most of which the clavicle is absent. It is fully developed only when the limb is used as a wing or hand, not as a supporting foot. The scapula

[1] *Spina*, a thorn. [2] *Pelvis*, a basin. [3] *Costa*, a rib.

is developed in proportion to the muscular activity of the shoulder joint, and is consequently large in man.

The HEAD, like the rest of the body, is formed of several vertebrate segments, but greatly modified to suit the requirements of the brain and face. It is divided into two parts, the cranium and face. The *cranium*, placed behind and above, is the neural canal expanded to contain the brain, and rising forwards over the hæmal part. It is formed of eight bones—the frontal, at the forehead; the occipital, behind; the parietal, at each side and above; the temporal, on each side, above and around the ear; and, in the base, the sphenoid and ethmoid.

The *Face* is the hæmal, or food and air, part of the head; presenting a double inlet, the nose for air, the mouth for food and air. It is composed of fourteen bones. They are—1. The malar or cheek bones. 2. Nasal. 3. Lachrymal. 4. Inferior spongy. 5. Palate. 6. Superior maxillary, or upper jaw. All in pairs. To these twelve remain to be added—7. The vomer or ploughshare bone, in the partition between the right and left nasal cavities; and 8. The inferior maxillary, or lower jaw bone, which is loosely jointed, in order that it may move in mastication. Most of the facial bones are small and arranged around the nasal cavities; and much the larger part of the face is formed by the maxillary bones, which surround the mouth and support the teeth.

The distinction of cranium from face, is very important in recognising the characters of heads in different individuals and varieties of mankind. The form and size of the face—that is, from the eyebrows downwards—is influenced by the development of the nasal cavities, and of the jaws; while the cranium corresponds to the brain. (See Fig. 1.) In the child, the face is very small in proportion to the cranium, for the double reason that the brain is very early developed, while the jaws and nose are as yet small. The female face retains more of the child form than the male. In old age generally, the alteration of the face is mainly owing to the loss of the teeth, and the subsequent absorption of their sockets, shortening the face, sinking the mouth, and protruding the chin.

The LIMBS in all vertebrate animals are formed on the same type or plan, however much each may be modified to render it an appropriate instrument for motion in the air, or in the water, or for climbing, running, or burrowing. The upper and lower limbs, therefore, correspond to each other, not only in divisions but in individual bones. These are modified so as to adapt the lower limb of man for supporting the body and for locomotion, and the upper for grasping ; the main purpose of the erect posture being to set free the upper limb for use as a hand.

In the following table, the names are arranged so as to show the homology,[1] or correspondence, between the bones of the two limbs :—(Fig. 3.)

Superior Extremity. (Fig. 5.)	Bones.	Segments.	Bones.	Inferior Extremity. (Fig. 3.)
Arm.		I.		*Thigh.*
Humerus.	1		1	Femur.
Fore-arm.		II.		*Leg.*
Radius and Ulna.	2		2	Tibia and Fibula (with Patella.)
Hand.				Foot.
First Carpal Row.		III.		*First Tarsal Row.*
Scaphoid. Semi-lunar. Cuneiform. Pisiform.	4		3	Scaphoid. Astragalus. Os Calcis.
Second Carpal Row.		IV.		*Second Tarsal Row.*
Trapezium. Trapezoid. Os Magnum. Unciform.	4		4	1st Cuneiform. 2d Cuneiform. 3d Cuneiform. Cuboid.
Metacarpal Row.		V.		*Metatarsal Row.*
One supporting each finger.	5		5	One supporting each toe.
First Phalangeal Row.	5	VI.	5	*First Phalangeal Row.*
Second "	5	VII.	5	*Second* "
Third "	4	VIII.	4	*Third* "

Thus each digit has three phalanges except the thumb and big toe, which have only two. In comparing the limbs, the hand must be brought into the prone position, that is, with the palm down ; the thumb then corresponds to the big toe, and is the first or internal digit.

It will now be evident, from this table, and the accompanying diagram of a pattern and complete limb (Figs. 4 and 5), that the plan or idea of a limb is as simple as it is beautiful. That it is formed, as it were, by two kinds of subdivision : first, *transverse* division into a series of segments, or divisions, succeeding each

[1] *Homology* (*homos*, like ; *logos*, a description), tracing resemblance, or common type, amid varieties. *Teleology* (*telos*, use or purpose, and *logos*), tracing the adaptation of the plan to the use in the animal.

Carpus, the wrist. *Tarsus*, the ankle. Metatarsus (*meta*, beyond) ; beyond the ankle. *Phalanx*, a battalion or row. *Digitus*, a finger. *Scaphoid*, *scaphè*, a boat ; *eidos*, like. Semi-lunar, halfmoon like. *Cuneiform*, *cuneus*, a wedge ; *forma*, shape. *Pisiform*, pea-like. *Trapezium* and *Trapezoid*, square-shaped, or like. *Os Magnum*, the largest bone. *Unciform*, hook-like. *Astragalus*, ankle-bone. *Os Calcis*, heel-bone. *Cuboid*, like a cube or solid square.

other end to end, in all eight in number,—thus enabling the parts to be bent up or straightened on each other; and, secondly, of *longitudinal* subdivision, or splitting of a segment into two or more pieces,—so as to allow the one to move upon the other, as in the fore-arm and leg, or of the separate motion of each, as in the case of the fingers and toes.

The *first* segment is always single, its office being to carry the entire limb about in all directions; and, to allow of this, the humerus and femur are always set on the body by ball and socket joints. The next joint, the elbow or knee, is a simple hinge, enabling the limb to be doubled up. The *second* segment presents two parallel bones, generally moving more or less upon each other. This allows the hand to be rolled up and down; and obviates shock in the transmission of force from the hand or foot. The patella, or knee-pan, belongs to a different class of bones, termed *sesamoid*,[1] which are developed in the tendons of muscles. Two such bones exist, and may be felt, at the metacarpo-phalangeal joint of the thumb, and the corresponding joint of the great toe; and in many of the lower animals, at the other toes as well. The carpus or wrist, and tarsus or ankle bones, are groups of short irregular-looking bones, allowing of free motion on each other, and thus obviating shock or abruptness, under force; but however modified, they are always arranged in two rows, and form the *third* and *fourth* segments of the limb. The full typical number of five in each row is presented in some animals. A glance at the feet of the bear, or any other five-toed quadruped, will show that the os calcis of the ankle corresponds to the cuneiform and pisiform bones of the wrist, joined together; thus accounting for the apparent discrepancy. The remarkable fact of the absence of a third phalanx in the thumb and great toe, has no essential refer-

FIG. 4.

FIG. 5.

Fig. 4. Pattern or type of a complete limb.

Fig. 5. The same wrought up into the human superior extremity.

[1] *Sesame*, an Indian bean; *eidos*, the shape.

ence to length, for, though it accords with the required shortness of the thumb, the great toe is not shorter than the other toes, and in most birds the longest toe has not the most phalanges. Light is thrown upon this, by the fact that in all five-toed quadrupeds the inner toe is the smallest and shortest, naturally accounting for the bone less; while, farther, this toe is the earliest to disappear, and first on the hind foot, in those animals which have fewer than five toes. It is, likewise, interesting to notice that this digit, which in quadrupeds is either small or wanting, is in man developed into the most useful and important of the five, the thumb and big toe; the former as an opposable finger for grasping; the other, still more characteristic of man than the thumb, as the great front support of a foot made for the erect posture. Yet Nature's law of the bone less is not departed from in man. Three phalanges, however, is not the extreme limit in vertebrate limbs. Additional segments are in some developed after the three; as, among mammalians,[1] in at least two of the fingers of the whale; and, in birds, the usual four toes have successively from within outwards two, three, four, and five phalanges; and the many jointed rays of fishes may be regarded as an illustration of the same principle carried to a greater extent.

The *material of which bones are made* is a compound of soft animal matter and of various hard earthy or mineral matters, chiefly phosphate and carbonate of lime. The animal part may be driven off by burning, or decay, leaving the bone brittle and crumbling; and the earthy parts may be dissolved by acids, leaving the bone soft and flexible, like a rope. The relative proportions of the hard and soft constituents vary at different periods of life, the hard increasing with age. Hence the bones of the child are soft and may even bend without breaking, while in old age they become brittle and more liable to break.

The osseous tissue, thus composed, is arranged in the bones in two forms, the dense or solid looking, and the cancellated or spongy. In the latter, the bony tissue is opened out, so as to give bulk, without at the same time increasing the weight, as at the enlarged ends of the limb bones, and in all masses of bone.

In the shafts of the long bones of the limbs, the dense texture forms a hollow cylinder, thus combining lightness with the re-

[1] Mammalia are animals which suckle their young, the highest class of the highest or vertebrate division of the animal kingdom.

quired size and strength. This is the true reason why these bones are hollowed out, and not in order that they may contain marrow, which is merely fat, and is placed there because it is the lightest animal solid. The same principle is carried still farther in some of the bones of most birds, the interior of the large and thin-walled tube being filled with air, giving them greater bulk and strength for the same weight, and rendering them relatively lighter in the air. A similar arrangement exists in several parts of the human head, as in the sinus, or cavity, of the upper jaw, between the eye and mouth; in the mastoid cells behind the ear; in the ethmoidal and sphenoidal cells, between the eyes; and in the frontal sinuses at the lower third or fourth of the forehead, and backwards above the eyes. In these situations, in the adult, the bones are hollow and filled with air from the nose; thus giving the required external size, without rendering the head too heavy.

THE JOINTS.

The parts concerned in the formation of a complete joint, or articulation, are—

1. The articular[1] surfaces of the bones, of various forms in accordance with the kind of motion.

2. These encrusted by a layer of *cartilage*,[2] elastic and naturally insensible, like a layer of India-rubber, serving to diminish the shock and friction which would have resulted from the forcing and rubbing of hard bones against each other.

3. A *synovial*[3] *membrane*, lining the interior, like a closed oil bag, not only containing but secreting its own oil or synovia; which lubricates the surfaces, like oil on machinery, rendering motion easy, and, in conjunction with the cartilage, preventing friction.

4. *Ligaments*[4] by which, as by cords or tapes, the bones are tied together, serving more precisely to check and prevent the movements from going too far.

The ordinary ligaments are made of white fibrous tissue, as a cord is of threads, only not twisted; and are soft and flexible like cords, but not elastic. Had they been elastic, they would have yielded and allowed the joints to dislocate easily, an accident which

[1] *Artus*, or *Articulus*, a joint.
[2] *Cartilago*, gristle.
[3] *Sun*, together; *ovum*, an egg. Like white of an egg.
[4] *Ligo*, to bind.

requires great force, and can take place only when the ligaments have at last torn across. In some situations they are stronger than the bones, as at the ankle, where an injury often breaks the bones but very seldom dislocates the joint; for dislocation at the ankle, or of any bone near it, is an extremely rare occurrence, however common it may be for the class of persons called "bone-setters" to persuade to the contrary those who are foolish or ignorant enough to trust them.

Some ligaments, however, are elastic, being composed of a peculiar yellow tissue endowed with this property. Such ligaments fill up the spaces between the neural arches of the vertebræ, and, yielding when the body is bent forwards, assist in restoring it to the straight position. The most remarkable collection of this tissue is seen in the "ligamentum nuchæ"[1] of the horse, and many other quadrupeds, which, stretching by its thickest part from the elevated dorsal spines forwards to the head, assists in sustaining the weight of the head, thus saving the expenditure and fatigue of muscular as well as nervous force.

THE MUSCLES.

THE muscles are the organs by which all movement is accomplished. We cannot walk, stand, or sit without muscular action. Even in sleep, it is necessary, for we cannot breathe without it, and the heart itself is a muscular organ.

Muscle, or red flesh, is a peculiar tissue composed of fibres, endowed with the vital property of contractility, by which it is enabled to contract so as to shorten itself. This contraction is called into play through the nerves, which transmit the motor influence from the brain or spinal cord. It becomes exhausted by action, which occasions the fatigue felt after exertion, and is renewed by rest. Thus, after we have held up the arm for a short time, the muscles become exhausted and we are obliged to let it drop; but we are soon able to raise it again. The effect of exercise is to enlarge and strengthen the muscles. Hence the strong arm of the working man, and the greater power of the right arm compared with the left.

Muscular fibre is arranged in large masses to form the muscles, and these are fixed to the bones usually by *tendons*,[2] by which the

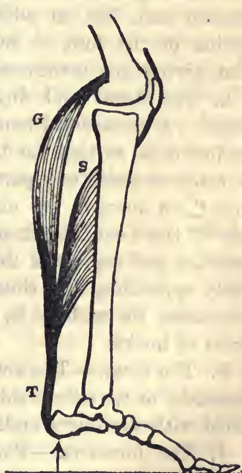
[1] *Nucha*, the nape, or back of the neck.

[2] *Tendo*, to stretch.

muscles pull, as by ropes. The muscles are placed in convenient situations, and are just long enough to give the required amount of shortening, while the tendons vary in length according to the distance of the bones to be acted on. Thus, the muscles which bend and stretch the fingers, lie in the fore-arm, and send long tendons across the wrist, and through the hand, to be fixed to the finger bones. The tendons of many muscles change their direction by passing round prominences of bone, over which they play, like ropes over fixed pulleys, while friction is prevented by the provision of a synovial lining. When there is no bone conveniently situated for this, it is managed by throwing a belt or strap across the tendons, below and against which they play, as in front of the ankle, and before and behind the wrist. It is long since man invented ropes and pulleys, but they existed as a Divine contrivance within the body of their first inventor.

The muscles are very numerous and form a large part of the body, especially of the limbs. They are generally arranged in opposing groups. Thus, the elbow is bent, or flexed, by the flexor[1] muscles in front of the arm, and extended by the three-headed extensor[2] muscle, behind. Again, the knee is flexed by the group of flexors, termed the hamstring muscles, behind, and straightened by the extensor group in front, which are attached to and assisted by the patella, or knee-pan.

FIG. 6.



Great muscles of the calf of the leg, and their tendon.
G Gastrocnemius muscle.[4]
S Soleus muscle.
T Tendo Achillis.

One of the most remarkable muscles in man is that which forms the calf of the leg. It consists of two large masses, one from the thigh bone,—the other and deeper from the bones below the knee. Both end in the great tendon, the tendon of Achilles, which is inserted into the lower part of the back of the heel bone, a little synovial bursa[3] enabling it to slip smoothly over the upper part. This great

[1] *Flecto*, I bend. [2] *Extendo*, to stretch out. [3] *Bursa*, a sac or pouch.
[4] *Gaster*, belly; *kneme*, the leg. [5] *Solea*, a sole. Like a sole-fish.

muscle and tendon are employed in walking to raise the heel from the ground, thus lifting the whole body. The other leg, thus also lifted, is then advanced, and the same process repeated with it.

Some idea may be formed of the variety of the joints and number of the muscles, by observing the movements by which the hand is rendered so useful as a universal instrument. Let the pupil try these motions with his own hand, in the order indicated in the following notes :—

1. The *fingers.* They may be moved sideways, so as to be collected close together, or spread so wide that the hand becomes broader than it is long. To show this, place one hand across the other. Next, they may be bent, first at the nearest, then at the farthest joint. The three pieces of the finger thus form a hook for holding, which is rendered still more complete when the joint at the root of the finger is also bent. The little and fore fingers can be extended separately with ease. This is because each has an additional extensor muscle. The separate motion of the fore, or index, finger, as in pointing, is peculiar to man, giving him a convenient teaching finger.

2. The *thumb* and fingers meet like the two sides of a pair of tongs. A metacarpal bone of the thumb is freely moveable, and set forwards, so that the thumb may oppose the fingers. It may be made to touch any part of the front of all the fingers; or to hold them down in the clasped position; or be laid against the side of the bent fore-finger; or, indeed, so moved as to give all varieties and degrees of the grasping power. Short, powerful, and freely opposable, the thumb gives the hand more than half its usefulness, for without it, the fingers would be little more than a series of hooks.

3. The *wrist.*—The entire hand may be here moved backwards, forwards, or to either side, and round about, as in describing a circle with the finger ends.

4. The *fore-arm.*—The rolling motion, termed pronation[1] and supination,[2] by which the palm is turned up or down, is performed in the fore-arm by the radius rolling on and across the ulna. This motion renders the hand equal to many hands.

5. The *elbow* enables the limb to be folded, so as to bring the hand to the face, or to strike a blow.

6. The *shoulder* enables the entire limb to be carried about in

[1] *Pronus,* lying on the face. [2] *Supinus,* lying with the face upwards.

every direction. Each joint adds to the utility of those below it, by placing the hand in new positions. The importance of each of these motions may be appreciated by supposing each joint in turn to be stiff.

The human hand surpasses all other limbs in its endless variety of motion, whereby, though in itself helpless enough, it is capable of seizing all instruments, and becoming each in its turn. It is, however, only an instrument. Skill in reality depends on intelligence; for all, including the idiot, have hands alike made, but not alike skilful. A capable instrument being provided, and intelligence possessed, practice alone is required to develop the use and skill of the human hand.

NERVOUS SYSTEM.

This is the most important of all the systems. Its functions are sensation and the regulation of motion, and the brain is, besides, the instrument of the mind. The brain and spinal cord together form one great continuous centre, to and from which the nerves proceed. The nerves are distributed to the muscles, for motion; to the organs of the senses, for sensation; and sparingly to most other parts of the body, both for sensation and for that influence which the nervous system exerts over the function of nutrition.

There are two kinds of *nervous substance.* The one, cellular in structure and greyish in colour, forms the "centres" proper, as in the brain, spinal cord, and the ganglia. The other is white in colour, and fibrous, or tubular, in structure, and forms the nerves and white part of the centres. The use of the white is merely to conduct impressions inwards to or motions outwards from the nerve cells. Although nervous and electric forces are in no way identical, the arrangements for them are so similar that they may be compared, the nerves to the wires, the cells to the batteries; the one conducting the force which the other has generated. Each ultimate nerve-fibre is a fine double-coated tube, serving for protection and insulation, while the interior is filled with a soft conducting substance. Each of these fine nerves is distinct from every other throughout its whole course, like the threads in a skein of silk, and thus we are enabled to recognise separate sensations from even near points, and to direct the will upon separate muscles.

Nervous centres are connected together by *commissures*,[1] composed of the same substance as the nerves. When these unite centres across the middle line, they are termed *transverse* commissures, and *longitudinal*, when connecting centres on the same side, or running longitudinally. The conducting tubules of the nerves and commissures are directly continuous with the cells of the centres, each cell sending off one, two, or, it may be, several processes to as many nerves.

MOTION.—Three conditions are requisite for motion. 1. A centre, from which the motor influence issues. 2. A nerve, to conduct the influence. And, 3. A structure—muscular fibre—capable of contracting under that influence.

Motions are either voluntary or reflex. In the former, the motor influence is the will originating in the mind, and acting through the brain. The reflex or involuntary action, is the result of an impression conveyed upwards to the nervous centres by the sensory, or afferent, nerves, although not necessarily attended by sensation. This may be illustrated by the electric telegraph. A voluntary motion is a simple message sent down from the capital to the provincial town; but in reflex action there is first the message up, which calls forth and regulates the message back. Each district, as it were, makes its wants known at head-quarters, and the call is immediately responded to, or reflected; while the despotic will, residing in the capital, sends out its commands in voluntary motion. Reflex motions are, as it were, self-regulating, and go on during sleep. Familiar illustrations of them, are, the acts of respiration, of swallowing, of closure of the glottis to prevent food or fluid passing into the windpipe, and the motion of the pupil under light. All of these acts are preceded by an impression which is conveyed to the brain, and there excites the motor influence, which is sent along the nerve to the muscles of the part affected.

SENSATION.—Nearly all parts of the body possess feeling in a higher or lower degree, but sensory nerves are mainly distributed to the organs of the senses. Three conditions are necessary for sensation, as for motion, but in the reversed order. 1. An organ to receive the impression, as the eye for light, and the ear for sound. Each organ requires to be peculiarly adapted to its own special function, and is thereby unfitted for receiving impressions of another kind, so that we cannot hear with the eye or taste with the fingers, although one sense

[1] *Committo*, to unite.

may, by practice, become more acute when another has been lost. The organs of special sense likewise enjoy common sensation, but an additional nerve is provided for this. Thus, the eye has the optic nerve for sight, and part of the fifth nerve for common feeling, and either function may be lost, by disease, while the other remains. 2. A conductor of the impression from the organ to the brain. The sensory nerves do not differ in structure from the motor nerves, being simply conductors, the function being determined by the organs and centres with which they are connected. 3. A centre to receive the impression from the nerves. Most of the sensory nerves enter the spinal cord, and the impression is forwarded to the brain, where all sensation is in reality felt, although we refer it to the part from which the nerve came. For instance, if the ulnar nerve, which supplies the little finger, be divided at the elbow, the finger loses all feeling, so that it may be cut or burned without pain. But, if the upper end of the divided nerve be touched, we feel the pain as if in the little finger. The impression has gone up to that part of the brain which has always been accustomed to receive impressions from that finger. Hence persons who have lost an arm or leg not unfrequently complain, long after, of pain as if in the lost parts.

The *Senses* are the inlets of knowledge, whether for the welfare of the body or the education of the mind; and the exercise of each is made, in addition, a source of pleasure. They are five in number. 1. Touch or common sensation, with the skin for its organ, but more or less disseminated through the body. 2. Hearing. Its organ, the ear, is a complex apparatus, constructed for receiving and transmitting sonorous vibrations. 3. Sight. 4. Smell, the organ of which is the upper part of the interior of the nose, with the olfactory nerve, appropriately placed to guard the entrance to the lungs. And, 5. Taste, guarding the entrance to the stomach, one of the endowments of the tongue, which, like the ear, eye, and nose, is also freely supplied with common or tactile sensibility.

1. The Skin is a complex structure, serving variously the purposes of protection, touch, and secretion. It presents two layers, the outer or scarf-skin, or epidermis, and the deeper or true skin, or cutis vera. The *epidermis*[1] serves to protect the sensitive true skin. When separated by a blister, the true skin is exposed, and touch

[1] *Epi*, upon; *derma*, the skin.

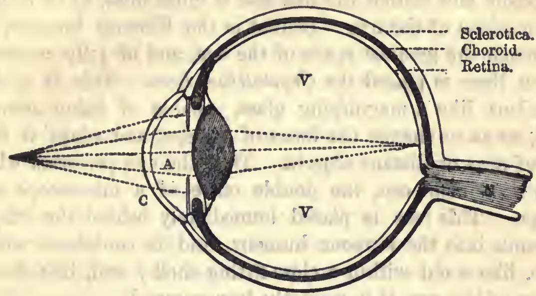
becomes painful. The deeper cells of the epidermis contain the pigment,[1] or colouring matter, which is present in the white as well as in the coloured skin, the difference being one of quantity only, and having reference mainly to the influence of light. The colour of a dark skin is thrown off by a blister, and is reproduced with the new epidermis. Markings of the skin made by the process of tattooing, or puncturing with needles dipped in colours, are permanent, because they are stainings of the true skin. The *cutis*[2] *vera* is tough, vascular, and sensitive. When touch is highly developed, numerous little papillæ stand out from the surface of the true skin, and are the especial organs of touch. On the palm and fingers they are ranged in rows, and occasion the surface ridges which the epidermis presents. On the last division of the fingers, these ridges may be seen to run more or less round a centre near the prominent part of the pulpy cushion there formed for touching with. The leather of commerce is the cutis vera of various animals, changed and preserved by the process of tanning. The *glands* of the skin are of two kinds, the sebaceous glands[3] which secrete an oily or unctuous substance to lubricate the surface ; and the sudoriferous[4] or sweat glands. The latter resemble a small soft tube coiled up into a ball, less than a small pin's head, and lying on the deep surface of the skin. The tube, leaving the little ball, like a duct, pierces through the skin, winding spirally through the epidermis, and opens on the surface by one of the little pores which may be seen on the ridges of the palm, full of moisture, when the hand is warm. These glands are found over the whole body, and when added together form a very extensive excreting surface, by which a large amount of fluid is daily thrown off, equal to about half that which passes off by the kidneys. Hence the importance of cleanliness to health ; of frequent changing and washing of the underclothing, and of regular ablution of the skin. Hence, in short, the importance of soap and water ; and the importance also of our bearing in mind that the face and hands are not the only parts which require the use of these important means of cleanliness and consequent sources of health. This law of health is greatly neglected, to the injury of other organs on which the additional work is necessarily thrown, and to the loss not only of the bodily advantages of a clean and healthy skin, but of its moral influence, an influence which gave rise to the old saying that "cleanliness is next to godliness."

2. The EYE consists essentially of an expansion of the optic (or

[1] *Pingo*, to paint. [2] *Cutis*, the skin. [3] *Sebum*, suet or lard. [4] *Sudor*, sweat.

seeing) nerve, the retina, for the purpose of receiving luminous impressions ;[1] and of a series of humours to act as lenses, arranging the rays in such a way that they may fall correctly on the retina. Various other structures are necessary to carry out these objects and complete the eyeball as a living optical instrument. Next come a series of

FIG. 7.



Section of Eyeball.
N Optic[2] Nerve.
C Cornea.[3]
A Aqueous humour.
L Lens.
VV Vitreous[4] humour.

The Iris is seen to intercept the outer rays of light, while the others meet in a focus on the Retina.

muscles and nerves to move the eyeballs ; and, lastly, the defensive and moistening apparatus provided in the eyelids and lachrymal organs.

The *Cornea*, the clear front of the eye, forms at once a wall to enclose the humours and a window to admit light. Behind it, like a screen, is the bright and variously coloured *Iris* ;[5] with its dark round central aperture, the *Pupil*, enlarging and contracting by the action of the iris, so as to regulate the amount of light admitted into the deep chamber of the eye.

The middle and hinder part of the eye consists of three coats or layers. 1. Externally, the white *Sclerotica*,[6] tough and strong like white leather, forming, with the cornea which it joins, a general protecting case. 2. The *Choroid*, composed mainly of blood-vessels, for the nourishment of the eye, and stained of a deep brown colour by the *Pigment*, or animal paint, which lines and darkens the interior of the eye behind the pupil. 3. The *Retina*,[7]

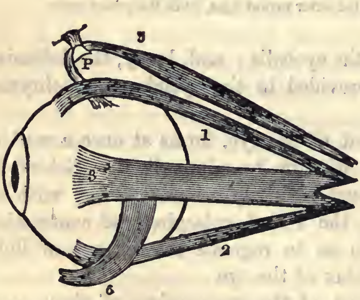
[1] Compare Lessons on Light in this volume, pp. 51-60.
[2] *Optikos*, belonging to sight.
[3] *Corneus*, horny, like clear horn.
[4] *Vitrum*, glass.
[5] *Iris*, a rainbow.
[6] *Scleros*, hard or dense.
[7] *Rete*, a net.

the nervous or sensitive coat, on which impressions are formed and thence transmitted by the optic nerve to the brain.

The shell thus formed is distended by three *Humours*, or refracting media, the office of which is to arrange the rays of light in a focus on the retina, so that an impression-picture of external objects may be formed on it.[1] The *Aqueous* humour occupies the front, before and behind the iris, and is quite fluid, so as to permit of the motions of the iris. Behind is the *Vitreous* humour, occupying much the greatest space of the eye, and of jelly consistence. Between these is placed the *Crystalline Lens*. This is a double convex lens, like a magnifying glass, capable of being moved or altered, so as to change the focus of the eye, and adapt it for the vision of near or distant objects. Thus the eye performs what no human instrument can, the double office of a microscope and a telescope. This lens is placed immediately behind the iris, partially sunk into the vitreous humour, and is contained within a capsule, like a nut within a close-fitting shell; and, like the other humours of the eye, it is perfectly transparent.[1]

The eye-ball is moved by six *Muscles*. The *Recti*, or straight muscles, four in number, proceed from the apex of the socket behind the eye, and passing forwards, like pieces of red ribbon laid against the eye, are fixed by short tendons to the white coat, about a quarter or third of an inch behind the cornea. They are—one superior, one inferior, one internal, and one external; each revolving the eye in its own direction, or in intermediate directions, when two neighbouring muscles act together. The other pair of muscles are termed *oblique*. They embrace the eye somewhat

Fig. 8.



Muscles of the eye seen from the outer side.

1. Superior Rectus.
2. Inferior Rectus.
3. External Rectus.
5. Superior oblique, and P its Pulley.
6. Inferior oblique. The dark parts of the muscles are fleshy; the pale parts their tendons.

[1] The eye of a sheep, or other quadruped, may be used to illustrate the above.

transversely, passing from the inside, one above, the other below; and their action, long misunderstood, is to roll the eye on its axis, when the head inclines to either shoulder, so as to keep the eye fixed on the object viewed. The superior oblique arises behind with the recti, but its tendon is reflected through a little pulley, which gives it the transverse action. Inward squinting of the eye is owing to the contraction of the internal rectus muscle, and, when established, can be removed only by division of the muscle; which, when efficiently performed, is not only simple and safe, but very successful in removing the distortion, as well as in restoring the vision of the eye.

The *eyelids* are moved by two muscles; one, from within the orbit or socket, raises the upper eyelid; the other, lying flat on and around the eyelids, is used in closing the eye. One eyelid, the upper, is made much larger than the other, as in this way one opening muscle is sufficient, while the eye is at the same time more completely washed and covered, as the line of meeting of the lids is below the cornea.

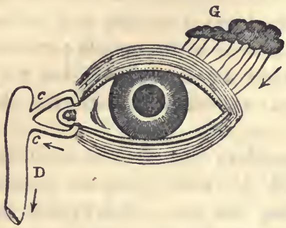
The eyelashes serve to protect the eye from dust, and to shade it from the light. Those of the upper lid are therefore longest and most numerous, and for a like reason the eyebrow is above the eye, as the sunlight comes from above. The eyelashes of the two lids, by curving first towards, and then away from each other, are enabled to meet before the eyelids meet, and thus exclude dust without excluding light. Their greater thickness at the middle, like the porcupine quill, gives them strength at the curve; and having attained a certain length, their growth ceases, as further growth would be extremely inconvenient. The growing and placing of an eyelash is a matter of no small importance, for the eye may be destroyed by a few growing in upon it.

The *lachrymal fluid* is secreted by a small almond-shaped body, the lachrymal[1] gland, which lies at the upper and outer side of the eye. About eight or ten fine ducts, or pipes, bring down the fluid, and shed it behind the outer half of the upper lid. It now flows over the surface of the eye, or is washed over it by the constant winking motion of the lid, which at the same time wipes off impurities. It would not do to allow this fluid to evaporate, as it would leave a residuum on the eye. It is therefore removed to the nose. Near the inner end of each eyelid may be seen, on

[1] *Lachryma*, a tear.

pulling it gently outward with the finger, a small hole which will admit a pin. This is the orifice of the canal, or drain, which leads to the nose. The two canals end in a larger one, on the side of the nose, the lachrymal sac[1] and duct,[2] which leads down to the nasal cavity, where the fluid is not only thus conveniently got rid of, but is of further use in moistening the nose, as waste water is sometimes employed to irrigate the neighbouring ground. To prevent the lachrymal fluid from running over on the cheek, there is a beautiful provision. The edge of each lid is square cut, like the edge of a table; the eyelashes grow along the outer margin, and along the inner may be seen, even with the naked eye, a row of from thirty to forty very fine points. These are the openings of the Meibomian glands, which secrete an oily or greasy substance. This greasing of the edges prevents the lids adhering to each other, and serves to turn the fluid and keep it within bounds, just as a greasy surface rejects water or ink. The fluid has no choice then but to flow into the drains which are open to receive it within the greasy line. When, under the influence of mental emotion, or when it is necessary to wash away some foreign substance, the gland secretes more actively, the fluid is then unable to escape by the drains, and, gathering at the inner corner of the eye, at last, like the swollen river, the tears overflow their banks, and roll down the cheek.

Fig. 9.



Apparatus for the secretion and removal of the tears.

G Lachrymal gland, and its ducts to the eye.

CC Canals for removal.

D Duct to the nose.

3. The Brain is divided into cerebrum and cerebellum.[3] The *cerebrum*, or great brain, is double, consisting of right and left halves, or hemispheres, joined across the middle by commissures. Each hemisphere is composed of two parts. First, the lower or deeper, composed of a series of *ganglia*, or masses of grey matter, named, from before backwards: 1. The Corpus Striatum;[4] 2. The Optic

[1] *Saccus*, a bag. [2] *Duco*, to lead.

[3] The teacher may illustrate this lesson by dissecting the brain of a sheep.

[4] Streaked Body.

Thalamus,[1]—these two being each about the size of a pigeon's egg, and joined across the middle by two small white commissures; and 3. and 4. Two small bodies, the Corpora Quadrigemina. These ganglia, with the cerebellum, and the parts joining them to the spinal marrow, correspond to the entire brain of the fish or reptile, and appear to form the essential part of a brain, as far as mere animal motion and sensation are concerned.

FIG. 10.

Plan of the brain as if by vertical section through one side.

A Cerebrum.
1 1 Convolutions.
2 Ganglia.
B Cerebellum and its three processes.
C Upper end of spinal cord divided, showing central grey matter, and the white columns.

Secondly, the outer and greater portion, composed of the *convolutions*.[2] These are ridge-like elevations separated by valleys, or sulci,[3] the opposed sides of which are separated only by the blood-vessels which nourish them; so that the rounded edges of the convolutions alone come to the surface, like the edges of the leaves of a closed book. The convolutions average the third of an inch in breadth, and an inch, or often less, in depth; thus increasing the surface for the grey matter by about six times, compared with what a smooth brain would have presented. Each convolution is composed, externally, of a layer of grey or vesicular matter, about an eighth or tenth of an inch in thickness; forming a continuous folded sheet over the whole brain, and internally of a central stalk of white conducting matter. The convolutions cover the whole surface of the hemisphere, and many therefore lie hidden in between the two hemispheres, and in the base, as well as where

[1] Optic Bed. [2] *Convolvo*, to roll together; rather to wind or turn.
[3] *Sulcus*, a groove or furrow.

they come in relation with the surface of the head, on the top, front, sides, and back. They are not isolated parts, as they appear when cut across, as in the diagrams, but, when seen on surface views, are tortuous and continually branching so as to be continuous with each other, like a network. They are not the same in different brains or even on the two sides of the same brain, as if intended simply as a means of increasing the surface, without regard to symmetry; though in those quadrupeds in which they are shallow and few in number, and also in different brains of the same species, they correspond exactly on the two sides.

The white or conducting matter of the hemispheres, issuing from the convolutions, is arranged in three ways. 1. Connecting the right and left hemispheres, and forming the great commissure termed the corpus callosum; thus enabling the two sides of the brain to communicate and act with each other. 2. Connecting the convolutions, with the body generally, passing down to the ganglia, or lower brain, and thence by the crus cerebri or great stalk of the cerebrum, to the spinal cord. And 3. Probably many fibres connect together convolutions on the same side, enabling them to act upon and with each other.

FIG. 11.

Vertical section showing the relation of the two sides of the cerebrum to each other.

1 1 Convolutions.

3 Corpus callosum.[1]

2 One of the ganglia[2] and commissure.

4 Crus cerebri.[3]

The *cerebellum* is about an eighth part of the weight of the cerebrum. It is placed below the back part of the cerebrum, which overlaps it a little, the two meeting just at the bony prominence which may be felt at the back of the head. The cerebellum, unlike the other parts of the nervous centre, is single, the middle line being occupied not by a commissure but by a portion of cerebellum. It has a plaited, rather than a convoluted look, but this is mainly due to the convolutions being parallel and subdivided by lesser ones, both on their edges and their sides. The result is, a proportionally much greater surface or package of grey matter, though the thickness of it is necessarily less, than in the

[1] Hard, or firm. body.

[2] *Ganglion*, a collection of grey matter, or a knot or swelling, on a nerve.

[3] Stalk, or leg, of the cerebrum.

cerebrum. Likewise, in the lower animals, as reptiles and birds, we observe that the cerebellum has become subdivided, while the cerebrum is yet smooth and simple; so that convolution, or plaiting, both begins first, and is carried to the highest extent, in the cerebellum.

The central white matter of each side of the cerebellum sends off three conducting processes, or channels of action, as seen in Fig. 10; one upwards to the cerebrum; a second downwards to the spinal cord; and the third and largest across to join its fellow, and form the commissure, or bridge of Varolius.

The SPINAL CORD, or Medulla[1] Spinalis, is about the size of an average finger above, becoming smaller below, where it ends opposite the lowest rib. Each half is composed first, of a central pillar of grey matter, which joins its fellow across the middle line, and is crescentic in form in a transverse section (Fig. 10). Secondly, on the outside, it is composed of two white columns, the posterior of which is mainly connected with the cerebellum, while the middle and fore part, or antero-lateral column, is connected with the cerebrum, and is joined across the middle to its fellow by a thin commissure.

The NERVES at their origin are forty in number. On each side, there are nine cerebral, the rest being spinal. The 1st *cerebral* nerve is the olfactory, or nerve of smell. The 2d, the optic. The 3d, 4th, and 6th are the motor nerves of the eye. The 5th nerve moves the muscles of the jaw, and gives feeling to the face and head. The 7th nerve gives motion to the features, by one portion; while the other is the auditory or nerve of hearing. The 8th nerve, partly motor partly sensory, is mainly the nerve of respiration and digestion. And the 9th gives motion to the tongue.

The *spinal nerves* resemble each other at their origin, having two roots, the anterior motor, and the posterior sensory, as first discovered by Sir Charles Bell. The posterior root, like all other nerves of common sensation, has a swelling, or ganglion on it, formed of intermixed grey matter. Thereafter, the two roots mingle together and form a compound spinal nerve. Ultimately, however, most of the sensory filaments go to the skin, while all the motor ones are distributed to the muscles.

FUNCTIONS OF THE NERVOUS CENTRES.—The spinal cord is partly a centre for reflex actions, and partly a conductor for sensation and voluntary motion between the brain and the spinal nerves. Its upper part, by which it joins the brain, termed the Medulla

[1] *Medulla*, marrow.

Oblongata, is the most vitally important part, as it regulates the respiratory act. Here about a third or fourth part of the fibres decussate or cross the middle line, which in part explains the singular fact that one side of the brain regulates the opposite side of the body. The remaining fibres decussate either above or below this part.

The cerebellum appears to be the organ which regulates muscular action. We are led to this conclusion by the correspondence in animals between its size and the activity of their motions; as well as by the results of direct experiment.

The cerebral ganglia appear to be the seat of sensation, and are probably also the centres for those reflex motions which are guided by sensations.

The functions of the convolutions are but ill understood, except in a general sense. In man they are enormously developed, and form as a whole the instrument through which the mind works, including the emotions and moral feelings as well as the intellect. That each faculty has its local connexion, as held by the phrenologists, is not admitted by physiologists as proved. Whether as a whole, or in parts, however, we know that this organ is the favoured seat of the necessary union between the two parts of man's nature, the mind and body. This union could not exist without the one influencing the other; and so we find, that, while on the one hand, mental action excites and employs and fatigues the brain,—on the other hand, that the state of the brain, as a part of the body, exerts an important influence on the mind. Thus irritability, peevishness, despondency, or their opposites, may depend simply on the state of the stomach, or on the want of exercise, fresh air, or a clean skin; so that the preservation of our bodily health is a duty which we owe to the mind, and to our neighbours, no less than to the body itself.

PART II.

THE DIGESTIVE, CIRCULATORY, AND RESPIRATORY SYSTEMS.

The parts subservient to sensation, motion, and intelligence, have now been considered, and the body might have served with these only, were it not that all living action is attended by waste

It was necessary, therefore, to give the body the power of self-renewal or repair; and hence the necessity for food. The conversion of food into the materials of the body is a complicated process. Blood is the fluid employed, and is manufactured from the food by the processes of digestion and absorption, after which it is carried by the blood-vessels to all parts of the body, and made the vehicle by which waste matter is removed from the different parts of our frame, and new matter laid down in its place.

DIGESTION.

The first step in the alimentary process is the seizing, or *Prehension*, of the food, which man accomplishes with his hands, while the lower animals chiefly employ the lips, tongue, and teeth. Next follows the process of *Mastication*, or chewing, accomplished by the teeth, tongue, and cheeks.

1. The TEETH are very hard, and shaped so as to cut like knives or grind like millstones. The child has the same number of teeth as it has fingers and toes, and similarly arranged as four fives; the adult a dozen more. The first, or temporary set, generally begin to cut the gum between the seventh and eighth month, and are completed in two years and a half or three years. Being unable to grow, they are displaced by the larger permanent set, which appear between the sixth and seventh year, and are completed by the thirteenth year; except the backmost, which may be delayed till the twentieth or thirtieth year, and is hence called the wisdom tooth. The eight, on each side of each jaw, are (naming them from before backwards),—two incisor,[1] one canine,[2] two bicuspid,[3] and three molar.[4]

The process of *Mastication* is assisted by the addition of the *saliva*, which is secreted by three pairs of salivary glands; the parotid,[5] which pours its fluid in at the cheek; and the sub-maxillary, and sub-lingual, the ducts of which enter below the front of the tongue.

2. The next stage is *Deglutition*, or swallowing. First voluntarily carried backwards into the pharynx, the food is thence involuntarily carried over the opening to the windpipe, down into the

[1] *Incido*, to cut into.

[2] *Canis*, a dog; corresponding to the tusk of carnivorous animals.

[3] Two-pointed, *Cuspis*, a point.

[4] *Mola*, a millstone.

[5] *Parotid*, *para*, near; *ous*, the ear.

œsophagus or gullet, by which it is conveyed away down through the neck and chest to the stomach.

Fig. 12.

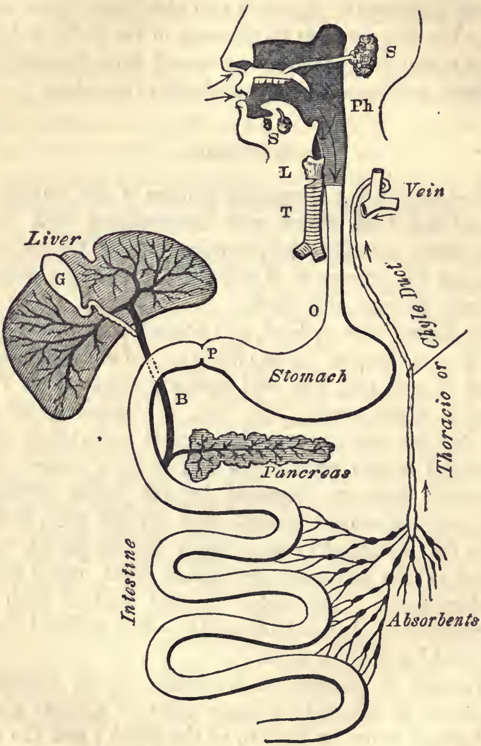


Diagram of the course of the food, from the mouth to its entering the blood at the jugular vein.

SS The three salivary glands.

Ph the Pharynx, the cavity behind the nose, mouth, and larynx. The two arrows show the course of the air from the nose to the larynx, and of the food from the mouth to the œsophagus

L Larynx.

T Trachea or Windpipe proper.

O Œsophagus, or Gullet terminating in the stomach.

P Pyloric orifice and valve, between Stomach and Duodenum.

G Gall-bladder and its duct.

B Bile duct, uniting with duct of Pancreas.

3. The STOMACH is a dilated part of the alimentary[1] canal, for containing and reducing the food. It is composed, like most of the other hollow viscera,[2] of three layers :—1. The external, serous,[3] which enables it to move smoothly about, gives it strength, and helps to keep it in its place. 2. The middle, muscular, which gives it contractile power, to act on the food by a kind of churning process, so as to mix up the digesting materials, and then force it onwards. 3. The internal, mucous,[4] or lining coat, soft and velvety, which is thickly studded with the little tube-like glands which secrete the gastric[5] juice. This gastric juice is the true digestive fluid, acting chemically, but formed in the stomach. It is an important fact that this fluid is formed and poured out, not in proportion to what we eat, but in accordance with the wants of the system. Hunger is a craving of the entire body for nourishment, to supply the waste attendant on living action, but is referred to, or felt in, the stomach. It is enough that we eat until this feeling is appeased ; whatever is more, merely overloads and distresses. Eating, like other healthy actions, has been made pleasant to us, but it is not meant that we should follow the example of those who, instead of eating in order to live, seem to live in order to eat. No organ, perhaps, is more unfairly dealt with than the stomach. By some, it is first overloaded and then pampered, for the mere animal pleasure of eating ; for which the simple cure is to put less in it. A famous physician well advised his over-fed patient, to live on sixpence a day and work for it. While, on the other hand, it is no less true that the want of sufficient food, among the poor, especially in early life, produces a degenerate frame and a weak constitution. The prevalent but decreasing custom of drinking alcoholic fluids—beer, wine, spirits, &c.,—is still more to be reprehended. That the abuse of them is injurious to stomach, brain, and system generally, and that they destroy life, is well known. No insurance office will accept the life of a drunkard. But it is now well known to physiologists that, even when used in moderation, they are only stimulants, and that the stimulation they produce is succeeded by a corresponding depression ; that they are "physic, not food," and physiologically and medically or

[1] *Alimentum*, food.
[2] *Viscus*, any internal organ.
[3] *Serous* membranes line the closed cavities, and facilitate motion, like the synovial membranes of the joints.
[4] *Mucous* membranes line those cavities, and passages, which open externally, and there become continuous with the skin.
[5] *Gaster*, the stomach.

the same footing, for instance, as opium. Let it be known, then, that the deep-rooted drinking custom of society is not a necessity, whatever its source may be. Of the many excuses people assign, the most common is, that they feel the better of it, as the Chinese says of his opium. If all men could use liquors in moderation, the philanthropist would have little occasion to remonstrate ; but as the use unavoidably leads to the abuse with many, it is highly important to proclaim, especially to the young, the great physiological truth, that all we require for health and enjoyment whether of body or mind, is a sufficiency of good food to eat water to drink, and plenty of fresh air to breathe.

The digested food, now in the form of a pulp, called *Chyme*,[1] is allowed to pass into the duodenum, having been previously kept back by the structure termed the *Pylorus* or gate-keeper of the stomach, which consists of a muscular ring, assisted by a fold of the lining membrane.

4. In the *Duodenum*,[2] or first part of the small intestine,[3] the chyme is mixed with the bile and the pancreatic juice, by which it is separated into two parts—the one, a finer part, called the *Chyle*, to be taken up by the absorbents, and the other consisting of matter which is useless, to be cast out of the body.

The Bile to which we have referred is secreted by the *Liver* from the blood which passes through it. The bile ducts unite to form one large duct, from which, before it goes down to the duodenum, a side duct is given off, which soon ends in a dilated sac, the gall-bladder, of the shape and size of an average pear. The use of the gall-bladder is merely to hold for a time the bile which the liver is continually forming, although between the times of digestion it is not needed in the duodenum. The bile duct is joined by the duct from the *Pancreas*,[4] and the common duct, resulting from the junction, enters the duodenum by a small orifice about three inches beyond the pylorus, having pierced through the soft coats so obliquely that regurgitation is checked as effectually as if it had been provided with a valve. (Fig. 12.)

5. *Absorption*.[5]—Next begins the process by which the chyle is

[1] *Chumos*, juice; *chulos*, juice.

[2] The duodenum (from *duodem*, twelve is twelve finger-breadths long.

[3] Intestine, or bowel; *intus*, within.

[4] Pancreas, *pan*, all; *kreas*, flesh.

[5] *Absorbeo*, to suck up.

sucked up by the absorbent vessels. To facilitate this, it is spread out over a large surface of intestine, which is many feet in length, and which, in order to increase the absorbing surface over which the chyle has to flow, is plaited inside. Some substances, such as water or alcohol, or solutions of salts, may be absorbed directly by the blood-vessels of the stomach, but the food proper is absorbed afterwards from the intestine, and is not, physiologically speaking, within the body until it has been absorbed.

The absorbent vessels spread themselves thickly on the intestine, like the roots of a tree in the soil beginning, by closed or looped ends in the numerous little tongue-like villi[1] which project into the intestine. Absorption takes place, not through apertures, but, like all the changes between the body and the exterior, by passing through the membranes, soaking through as it were, only in obedience to a vital force. The absorbent vessels from the intestine are termed the *Lacteals*,[2] while those which take up lymph from other parts of the body are termed *Lymphatics*.[3] Passing through a series of glandular bodies, the lymphatic glands, which further prepare the chyle, that thick white fluid then enters the thoracic duct, a vessel somewhat less than an ordinary quill, and, like the other lymphatic vessels, well guarded with valves. After travelling up through the back part of the chest, near the œsophagus, the thoracic duct, as seen in Fig. 12, at last ends in one of the veins at the root of the neck on the left side; and there the course of the food is completed, and the blood renewed or fed by the addition of the chyle.

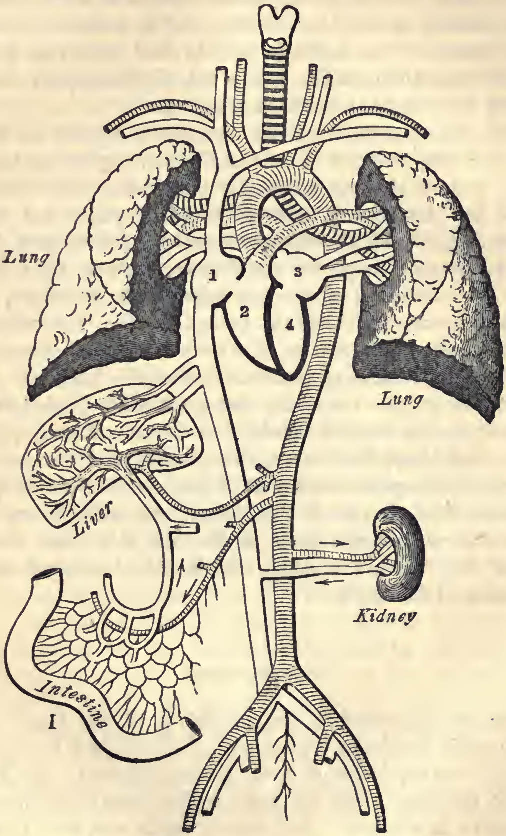
CIRCULATION.

The organs concerned in the circulation of the blood are the heart, arteries, capillaries, and veins. The arteries take it out from the heart; the capillaries give out the nourishment; the veins return it to the heart; and the heart is the force-pump which keeps it moving on in a circle. Before being again sent round the body, it is sent to the lungs for purification, and hence we have a double, or figure of 8, circulation; the larger, or systemic, circle of distribution to the body generally, and the lesser, or pulmonic,[4] circle to

[1] *Villus*, a tuft. [2] *Lac*, milk, from the milky appearance of the chyle.
[3] *Lympha*, water, from the clearness of the lymph. [4] *Pulmo*, a lung.

the lungs only. The heart, to carry on a double circulation, requires four cavities, into which its interior is divided by partitions,—an

FIG. 13.



1. Right Auricle. 2. Right Ventricle. 3. Left Auricle. 4. Left Ventricle.

The blood-vessels with the light cross-markings are systemic arteries, and may be coloured red. The great systemic artery, the *aorta*, arises from cavity No. 4, concealed by the pulmonary artery. From the convexity of the arch which it forms, are given off, first, the brachio-cephalic, or right arm and head, artery; second, the left carotid to the left side of the head; and third, the left subclavian for the left arm. The corresponding veins unite to form the vena cava superior. The aorta now turns down in front of the spine, and divides on the *auricle*[1] and *ventricle*[2] on each side, right and left, the auricle being merely the ante-chamber to its ventricle, while the ventricle is the strong cavity for filling the arteries.[3] The right ventricle sends its blood by the pulmonary artery to the lungs, the left by the aorta to all parts of the body.

The course of the blood then is as follows :—Beginning at the right auricle, No. 1, this cavity receives the blood from the great systemic veins. The right auricle then contracts and fills cavity No. 2, the right ventricle, which in its turn contracts and sends the blood along the pulmonary artery, and its divisions, to the lungs. Purified in the capillaries[4] or hair-like vessels of the lungs by the influence of the air which we inhale, and changed from dark or venous, to red or arterial blood, it now returns by the pulmonary veins to cavity No. 3, the left auricle, by which it is sent into cavity No. 4, the left ventricle ; which, finally, contracting powerfully, discharges it into the aorta. From this great systemic artery the blood is distributed at last to the systemic capillaries, blood-vessels which, in minute ramifications, pervade every part of the body. Through the walls of these capillaries it deposits new matter in the tissues of the body, and in consequence of this, becomes changed from red or arterial to dark or venous blood. Having served this purpose, it now passes onwards to the veins, by which it is collected, and at last brought by the two great systemic veins, the vena cava superior, and inferior, to the right auricle, where we began to trace it.

The action of the ventricles would be of little use in propelling the blood if *valves* were not provided to prevent regurgitation. Accordingly the inlet and outlet of each ventricle is guarded by

fourth lumbar vertebra into the common iliac arteries ; these divide into the internal and external iliacs, the latter being the artery for the inferior extremity.

The *pulmonary artery*, arising from No. 2, is marked with dotted crossed lines.

The clear vessels are the *veins*. Those connected with No. 1 of the heart may be coloured blue. Those joining No. 3. are the pulmonary veins, and are seen, two in number, at the lower part of the root of each lung. The pulmonary veins may be coloured red.

The dark tube with strong cross-markings leading to each lung, is the windpipe, surmounted by the larynx.

The liver is seen to receive a large vein, the vena portæ, in addition to its artery which is small. The returning veins, or veins proper, of the liver are seen entering the vena cava inferior.

1 *Auricula*, a little ear, from a fancied resemblance.

2 *Ventriculus*, a small belly, or cavity.

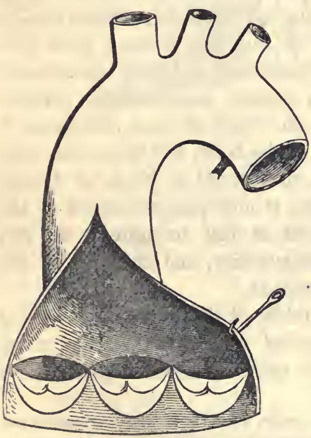
3 *Arteria*, from *aer*, air, and *tereo*, to pierce through; from the ancient notion that the arteries conveyed air, because they are mostly found empty after death.

4 Capillary, from *Capillus*, a hair of the head.

valves. The valve at the inlet is termed the auriculo-ventricular, right and left, or *tricuspid*[1] valve on the right side, and *mitral*[2] valve on the left. It is composed of an apparatus of membranes, cords, and muscles, like the sails of a boat with their ropes. When the blood tends to regurgitate, the membranes are floated back, against each other, the cords prevent them being washed through, while the muscles shorten the cords, like sailors holding on by and tightening the ropes of a sail.

The outlet of each ventricle is guarded by the three *semi-lunar* or halfmoon-like valves. The whole body is full of evidences of design, but perhaps no part presents a contrivance at once more simple and beautiful than this. These valves, shown in Figure 14, may be compared to three swallow's nests built in the mouth of a pipe, but made of soft silk-like membrane, so as to be easily pushed aside and down again. The part of the wall at and above the cavity of the nest is excavated, or bulged out, forming the so-called sinus or hollow of Valsalva. The blood having in its passage upwards, driven the valves aside, now tends to regurgitate, but getting behind the valves,—which is made quite sure of by the existence of the sinus,—throws them down and against each other, so that the aperture is completely blocked up. This action is perfectly mechanical, as may be proved by experiment on the dead animal. The same principle is carried out in the veins and lymphatic vessels whenever a valve or pair of valves exists, each being provided with a sinus, or bulging, behind it, to make quite sure of the valve being thrown down.[3]

FIG. 14.



Aorta slit open, showing the three semi-lunar valves. The dark spaces above each valve are the sinuses of Valsalva.

[1] Tricuspid, three-pointed.

[2] Mitral, from a fancied resemblance to a mitre; also termed bicuspid.

[3] These, and the other valves of the heart may be demonstrated from the heart of a sheep, or other quadruped. The semi-lunar valves are seen on slitting up the aorta and pulmonary artery; the tricuspid and mitral valves, on opening the ventricles.

The making of these semi-lunar valves would seem an easy matter compared with their preservation. When we recollect that, at every pulse of the heart they are dashed up, and then dashed down again with such force as to cause a noise which may be heard externally, and is known as the second or sharp sound of the heart; that they bear a strain equal we may safely say to a pound weight, until again dashed up by the next pulse; that this takes place seventy-five times, more or less, in a minute, that is, 4500 times every hour; that their texture is thin, and that their giving way would be fatal; and when we consider how short a time any such contrivance of ours would stand so much rubbing,—we can understand how wonderfully we are made, and how far the wisdom and power of God passeth that of man.

NUTRITION—SECRETION—RESPIRATION.

1. The immediate source of nourishment is the blood. The process of *Nutrition*[1] or assimilation, takes place through the walls of the capillaries, which so closely pervade almost every part of the body that a fine needle cannot be introduced without drawing blood, and is, indeed, a very coarse instrument among them. The change is a double one, new matter being laid down and waste matter taken up, the circulation performing at once the double function of the baker's and the scavenger's cart. The process is the result of a vital power given to each tissue[2] by which it is capable of reproducing its like from the common supply; and likewise in the case of different animals, as the dog and cat, each builds up its peculiar framework, it may be, from the very same kind of food. It is so ordered that like shall produce its like, whether in the case of texture, individual, or species.

2. Waste matters are cast out of the body by several secreting, or excreting, organs: the lungs, liver, kidneys, and skin. *Respiration*, or breathing, is the most important of these means, removing carbonic

[1] *Nutrio*, to nourish.

[2] *Tissue*, or *texture*, the term applied to the elementary structure of which any organ is composed. Thus we speak of muscular tissue, osseous tissue, nervous tissue, &c. A mass of muscular tissue forms a muscle, of bony tissue, a bone, and so on. The peculiar elementary character of the tissue is seen by examination with the microscope. Thus ligament, or tendon, is composed of fine fibres or threads; nerves, of fine tubes; fat, and grey nervous matter, of minute cells. When several simple or elementary textures are woven together, as in the skin and other membranes, we speak of these parts as compound tissues. Each tissue has its own vital properties.

acid, or poisonous gas from the blood. besides throwing off watery vapour, and introducing oxygen, or pure gas, into the blood in its stead. The general effect of the animal and vegetable kingdoms on the atmosphere is opposite; the animal removes oxygen and supplies carbonic acid; the vegetable consumes carbonic acid and sets free the oxygen; these two great kingdoms of nature thus balancing and supplying each other. The breathing of a number of persons, therefore, gradually poisons the air of a room, by impregnating it with carbonic acid, causing first warmth, and then drowsiness; and, were all the doors and windows quite closed, death would gradually ensue. Hence the necessity for the ventilation of our houses, schoolrooms, workshops, and places of public assembly. No law of health is more neglected than this one, as if it were an object to shut out the light and the fresh air of heaven. This neglect, aided by insufficient clothing and nourishment, is one of the most fruitful causes of ill health and disease, especially of consumption.

3. The mechanical part of respiration is accomplished by the chest's moving like a pair of bellows, but without the hole below, the air being drawn in, as well as pushed out, at the nozzle; while the muscles attached to the ribs do for the chest, in respiration, what those of the hand and arm do for the bellows. At the upper part of the windpipe, is placed the *Larynx*, in the interior of which is the *glottis*, a triangular narrowed part, left between the vocal cords, which, by enlarging and contracting, and by the varied tension of the cords, acts both as a valve or check on the passage, and as the producer of vocal sound. Articulation, or speech, is effected by the parts above, as the lips, teeth, tongue, palate, and nose; and is, like learning to play on any other instrument, an artificial acquirement. Hearing is necessary to it, and hence those born deaf must remain dumb; rational intelligence is no less indispensable, and hence the imbecile and the lower animals cannot be taught to speak.

The windpipe proper, or *Trachea* (Fig. 13), divides for each lung, and ramifies like the branches and twigs of a tree, ending at last in little rounded air cells. The lung is composed of an immense number of these little air cells. The pulmonic capillaries form a very close network on and in the delicate wall membrane of each cell, and the exchange of gases takes place through the membranes, the pure air passing into the blood, and the impure gas passing out from the blood into the air cell. The carbonic acid or impure gas set free is not formed here, but in the capillaries throughout the body, where, in consequence, animal heat is produced, the process being chemically analogous to ordinary combustion, in which oxygen is consumed and carbonic acid set free.

When we consider the amount of action attending even moderate exercise, and going on in the living processes even during sleep, and the consequent waste giving rise to the constantly recurring demands for food,—it is evident that a rapid process of *Change* is going on in our bodies. It is interesting to think of this, and at the same time of the similarity of the new to the old. Like the stream of the river, there is, as it were, a slow current of matter passing through us, lodging only for a short time and then swept away. As an ancient philosopher has well remarked, we cannot cross the same river twice at the same place; and so the body we inhabit to-day is not altogether the same that we inhabited yesterday, possibly none of it the same that we inhabited a year ago. Like the water of the river, all is new, and yet we speak of the same river and the same body.

The rapidity of the change will depend on the activity of each part, the more active will change most frequently, and we change more rapidly at one season than another. While the blacksmith and the tailor change their hands oftener than their feet, it will be the opposite with the postman; and the right hand will be renewed oftener than the left. Thinking men will have new brains, and teachers and orators new tongues, while the thoughtless and the silent are still going on with the old ones. The only parts perhaps that do not change, or at least do not seem capable of renewal, are the little shells of enamel which cover the exposed part of the teeth.

It is this inherent power of renewal, even more than the wisdom of the invention, which distinguishes the Creator's work from man's. The best way to preserve our handiwork is to lay it by, but nature's machinery improves with use, nay, will even disappear unless used. The clothes we make for ourselves get thin and ragged with that use which makes the skin below them grow thicker and healthier; and every stroke on the blacksmith's anvil lightens the hammer but strengthens the arm that wields it. And so nature's renewing process goes on until it is arrested by the law of death, when the forsaken body resolves itself into its component elements, and returns to the dust from which it came.

In connexion with the subject of waste and repair, it is important to recognise the effect of *Exercise* on the health. As has been already remarked, use is necessary to the preservation of living texture, and has the effect of increasing and strengthening it, provided, of course, that it is not so excessive as to induce exhaustion or over-action. In active exercise, the muscles are directly employed, and the effect of the exercise is to enlarge them, and also to enlarge the bones, thus giving us greater strength of limb and body generally. Compare, in illustration of this, the size and power of the blacksmith's or labourer's arm with that of the sedentary clerk or the invalid. But independently of increased strength, exercise brings a healthy condition by circulating the blood more rapidly, and by rendering the blood itself more pure. When the muscles act they compress the veins, and, as these are provided with valves which prevent regurgitation, the current is driven rapidly forward to the heart. Increased action of the heart results, and this, again, is followed by increased respiration. The want of sufficient breath which we soon feel on starting suddenly to run, is owing to the venous blood being sent forward more rapidly than the lungs can or will at first let it through. But if we begin the race more gradually, the blood becomes so purified that the lungs offer no obstruction. The effect of the increased force and rapidity of the circulation is to send the blood more freely into every part, carrying off the waste and laying down new matter more rapidly. The blood is rendered more pure by the increased frequency and volume of respiration. A more highly oxygenated blood therefore is circulated throughout the body, by which every organ benefits, and none more so than the brain, on which venous or impure blood acts as a poison. Hence the importance of exercise being taken in the open air (not to speak of the freedom which it permits), that we may inhale air free from the impurities with which the confined atmosphere of inhabited rooms is quickly saturated. Exercise in games, too, and in the society of others, is much preferable to solitary and monotonous walking or working, as in the latter the same muscles are continuously used, and there is no amusement or excitement to lead the mind away from dwelling on the cares of business and study. Gymnastic training in schools and public games for adults, should be much more general than they are.

It must not be overlooked that *Repose* is a law of health as well as exercise. All action induces more or less exhaustion, and, as waste has been going on more actively than renewal, repose is necessary in order that renewal may proceed more actively than waste. The ordinary fatigue attending exercise is chiefly in the muscles, whose power of contraction becomes exhausted, but is restored by rest. Simple cessation from labour appears to be sufficient for this, while sleep is essentially the repose of the nervous system and more especially of the brain. The reflex actions of the spinal cord and lower parts of the brain, alone remain in operation to carry on respiration and those other reflex actions which go on during sleep independently of sensation and consciousness. But in profound sleep, all sensation and consciousness of mental action and existence are suspended, as much so as if for the time they were dead. We have already seen that the mind uses the brain as it works, and, accordingly, the brain must have its rest like other organs. This it may have by changing the subject of study, but periods of entire relaxation and ample sleep are no less necessary for those whose labour is mental, than for those who labour with the hand. Sleep, therefore, in which man spends about a third part of his life, is not lost time or a thing to be neglected, but is that intended period of repose and restoration which enables us to act and work during the other two-thirds.

CONCLUSION.

Let us now, in concluding this brief sketch, take a view of the position of man in the general scheme of creation.

Taking a wide survey, we find a successive dependence of the great kingdoms of nature : the *mineral*, or inorganic, kingdom —the earth, the air, and the water—supports the *vegetable* kingdom ; after which, and dependent on it, follows the *animal* kingdom. Next, within the latter, we trace the gradual development of a brain, an organ fitted to become the instrument of intelligence. Lastly comes man, made as we are told in the image of his Maker —that is, in mind ; and, as the human problem was to unite a mind to a body, we find an enormous brain provided as the seat of the mysterious union. Thus the whole scheme of nature rises up till it finds its completion in the human brain, and may be likened to a great pyramid in three successive zones, the mineral, vegetable, and animal, towering upwards to a summit, on the top of which is placed a human brain, the habitation of the mind, there fitly placed as the connecting link between the material and mortal below and the spiritual and immortal above.

But the human figure is not distinguished merely by its great brain. Man is placed upright, on two limbs, and, though not the only biped, is the only straight or erect biped; and he is erect chiefly that his other two limbs may be set free to be used as hands. To these two great central ideas, the large brain and the erect posture, all the lesser characteristics are referable. The erect posture requires the plantigrade foot, and this, again, the great inner toe. The long lower limbs, forming one-half of his entire length, enable him to take long steps and elevate him, as on two pillars of observation. His broad chest and shoulders enable him not only to balance himself in the erect posture, but to lie comfortably on his back; and they also support conveniently his active working instrument, the hand, which is there attached to his body. The great brain gives the forehead, and the no less characteristic hind-head; and by his free hand, with intelligence to guide it, he is enabled to dispense with long jaws and sunken snout, and to have in their place a chin and prominent nose, peculiar characteristics of the "human face divine."

Man, then, is intended to work, as well as to feel and think. He alone is progressive, and engaged in intelligently operating upon and modifying the earth's surface, round and upon which myriads of human hands are working. Without the senses, he could not be educated; and without hands, he might be knowing, but would be very useless. The object of his existence may be typified in three organs, the eye, the hand, and the brain;—the eye, with which, sun-like, he scans the world; the hand, with which he hammers the world; and the brain, with which he knows the world, and by which he becomes, as Shakspere well defines him, "the Being of large discourse looking before and after." And yet we must not forget that the brain is only the instrument, that the mind itself has a constitution; and it is this mind which —guided by the revealed word of God, and strengthened and enlightened by the contemplation of the works of God in nature— tells us of the long past, and of the eternal future, and is the source of all true pleasure in the present exercise of the parts of our double nature.

Enough, it is trusted, has been said to lead the pupil to follow the study of the human body farther than the prescribed limits of this treatise permit. Much might be said in advocacy of the wide diffusion of such knowledge. It acquaints us with the laws of health, and puts it in our power, if we choose, to avoid much disease, and suffering, and loss of time. The Creator manages all this for the lower animals through their instincts, which they blindly but securely follow. And while much of this is fixed for us also, much is left to us to find out through reason and experience; and thus it is for man himself to choose whether he shall fall below the level of the beasts by allowing the body to overcome the mind, or shall rise to all the high capabilities of his physical nature, by subjecting the body to his reason, and by the careful observance of the laws of health. That we cannot, either as individuals or communities, transgress the laws of health with impunity, is in itself a sufficient reason for our studying and obeying them; to which we may add the grave consideration that, as these laws are of God's making, obedience to them becomes a duty to our Maker as well as to ourselves.

But, perhaps, no argument is of more direct weight than the consideration of the influence which our bodily health has upon the mind. Our mental progress and disposition, on which may hang also the happiness of others, are largely influenced by attention to the health of the body. When we think of this, it becomes evident that temperance, cleanliness, exercise, breathing fresh air, and sufficient repose, are virtues and *duties* of no small importance.[1]

[1] Some knowledge of our own bodies will serve also to protect us from the impositions of the charlatan; and that this is no small matter will be evident when we think of the vast sum of money annually spent in the mere advertising of quack medicines, to say nothing of their consumption, or of the profits of those who thus prey upon the credulity of their fellow creatures. Education, in the general sense, affords no protection against this; unless it includes a knowledge of physiology; for this alone can enable us, for instance, to detect the bone-setter who professes to have replaced a bone which does not even exist, or to understand the absurdity of professing to cure every disease by one medicine or one means. It is such knowledge alone which can enable the public to distinguish between the bold and therefore (with the ignorant) successful promises of the empiric, and the rational and moderate statements of the qualified medical man; and to comprehend how it is that cures are effected by working through and upon nature's processes. Trust in the medical practitioner, instead of being a kind of blind superstition, then becomes an intelligent faith.

VEGETABLE PRODUCTS AND THEIR USES.[1]

I.—THE BREAD-STUFFS OF OTHER NATIONS.

God in his goodness has covered the earth which we inhabit with herbs and trees, which furnish us with food, clothing, materials for sheltering ourselves from the weather, and many other articles which contribute to our comfort and luxury. Whatever part of the world we visit, we find that the wants of the inhabitants have been provided for, the earth yielding its rewards to their industry and skill. Even the uncivilized savage, ignorant as he is of the properties and uses of the various natural objects around him, can find means of sustenance and shelter. Were we to confine our attention even to the Food of man alone, we should find it a wide field of interesting and instructive inquiry; so wide indeed that our limits would not admit of its being adequately treated. It will, therefore, be of more service to the reader if we confine our attention to one department of the subject, the vegetable products of the earth, and the uses to which man, by the exercise of his reason, has been able to put them. We shall begin with the vegetables which yield bread to men.

We find that almost every country has some production which, when collected with care and industry, will furnish the means of sustaining life. But the same food would not suit all nations, because different degrees of heat or cold has such an influence on the physical frame, as to make different kinds of food necessary. In cold countries, for example, men require much more nutritious food than they do in hot climates, and therefore it is, that in the East Indies and China, the natives rarely use wheat to make their

[1] The teacher should endeavour to procure the objects referred to in the succeeding lessons. No lesson having reference to external objects should be read without an effort being made to place the reality before the pupils. It will be found that the lessons of this volume are generally founded on things easily obtained, or on experiments easily made.

bread, but prefer rice, a much lighter grain, which they cook in a variety of ways. Again, they rarely eat any flesh-meat, so necessary to health in the severer northern climates, but are content to mix butter and milk with their rice as a sort of substitute.

1. *Rice; Maize or Indian Corn.*—The Rice-plant is a species of grass growing very much like our own beautiful oat. When ripe, the grains are each enclosed in a yellow-husk, and hang in handsome clusters on very thin stalks. As the plant grows best in very moist soils, low lands, subject to floods, are preferred for the cultivation of it. When rice is thrashed from the straw, it is still, like the oat, enclosed in the yellow husk, and in this state is called *Paddy*, both by the natives and by Europeans. Before it can be used for food the husk must be removed, and this is done amongst the poorer people, by rubbing the grain between flat stones, and winnowing or blowing the broken husks away. Machines skilfully constructed for the purpose are, however, in general use. This grain forms the chief food of the natives of India, of the Chinese, the Japanese, and other Eastern nations. Large quantities are also brought to Europe, but by us it is used more as a cheap luxury for puddings than as a necessary.

If we now pass from the hot countries of Asia to North America, we shall find that the change of temperature renders necessary a more substantial kind of food, and that the soil is adapted to supply this new want. Maize or Indian corn is there cultivated to a very great extent, and it appears to suit the taste of the inhabitants exceedingly well, although few persons in this country like it. The Indian corn is a plant of the grass tribe, but it produces its fruit in a very different manner from wheat, barley, rye, oat, or rice. The plant is much larger than any of these, often growing to the height of eight feet, with a stem as thick as a broom-handle, and bearing the corn in ears of considerable size, called cobs, which spring from the sides of the stem. The cobs are enclosed in a large leafy sheath, which is much used for making paper in the United States; and in Spain, Portugal, Sicily, and the Azores, where this corn is also grown, these sheaths are employed in great quantities as wrappings for oranges. Nearly every orange or lemon which comes to this country is wrapped in one of these sheaths before being packed into chests, as it is found that these fruits decay very rapidly if some dry material does not keep them apart from one another. They are also used for making cigarettes, which frequently consist of a small portion of cut tobacco rolled up in a piece of the Indian corn sheath. The grains in each ear are very closely packed in rows all around a pithy stem, which forms the centre of the *cob;* this pithy centre also has its use, being frequently cut into a kind of cork for stopping bottles and small casks. They form also a very cheap and useful fuel.

2. *Mandioca; Sago; Turkish Millet.*—In South America again, the chief food of the inhabitants, both of native and European origin, is derived from a large root which grows wild, and is cultivated in very large quantities. It is called the Mandioca plant, and when growing is very poisonous; but its roots, which, when ripe, are larger than a Swedish turnip, yield a great quantity of very nutritive starch, which, after having been exposed to the heat of a fire, is perfectly harmless. The fire destroys its poisonous quality. When roughly prepared, as it usually is for general use, this root is called *Mandioca Meal,* or in Portuguese, Farinha; but when carefully prepared for the European markets, it is called Tapioca, and may be bought in all our grocery shops. The natives have a very simple method of preparing the meal of the Mandioca root for their own use. Having first washed the roots, they grate them upon a large wooden rasp, made from one of the very hard woods which are found in their forests. The grated material is received in cold water, which becomes white in consequence of the starch which is so abundant in the root. The woody particles of course float, and are easily removed, and as soon as the more weighty starch has settled to the bottom of the vessel, the water is poured off. This starchy sediment is then dried over a slow fire, a process which deprives it of all poisonous qualities, and renders it a very wholesome food.

This is not the only kind of starch which forms the ordinary bread-food of foreign people, for in the islands of the Indian Ocean, inhabited by the Malays, several beautiful palm-trees produce vast quantities of starch in the pith of their large stems, which is separated by washing with cold water in a way similar to that just described, the starch being afterwards gradually dried and passed through small sieves made of the fibres of the palm leaves. In passing through these sieves, the starch is formed into little round grains, not so large as small leaden shot, which acquire a glossy appearance when thoroughly dried over a charcoal fire. The preparation is then finished, and the starch of the palm-trees has become *Sago*, which in the Indian Islands is the chief food of the natives. It is exported in large quantities to Singapore, whence it finds its way to Europe under the name of Pearl Sago, and is used extensively for puddings.

Through Turkey, Northern Africa, and many parts of India, the natives use a kind of grain which goes by various names, in the different places in which it is used, but which is commonly called Durra or Darra. In this country it is called Turkish Millet, and is in shape like the grains of Indian corn, but very much smaller. There are several kinds of this grain, the commonest being white; another is white, with a black spot where it springs from the stalk; a third is black; and a fourth red; the two last are used chiefly for feeding cattle. The Turkish Millet is very beautiful in its growth, and is uncommonly productive. The grain, when ground, forms a fine white flour, which is made into cakes, and is said to be very nutritious.

We have now mentioned the principal articles which constitute the Bread of other nations, except those which are grown in our own country, such as wheat, barley, oats, and rye, and which furnish bread to those who live in temperate latitudes. These are so well known that any description of them would be useless. We shall next speak of

II.—THE CHIEF FRUITS OF THE WORLD.

When we pass through the streets of a large town and see the various fruits exposed for sale, we cannot fail to observe that most of them come from far distant countries. We ought all to know something of their history, for if they suggest nothing to our minds beyond the fact that they are pleasant eating, we are in that respect on a level with the beasts that perish. *To know* is itself an enjoyment, and when the orange in our hands reminds us also of the warm sunny countries in which it grows, the beautiful tree from which it was gathered, dazzling the eye with its golden fruit and filling the air with the sweet perfume of its silvery white blossoms, our pleasure becomes that of rational creatures.

1. *The Orange.*—As we have mentioned the Orange, we will give some account of it first. This fruit has been so long a favourite with mankind, and has consequently been so extensively cultivated,

that it is now hard to say from what part of the world it first came. Some think China and Northern India its native countries, and they are probably right. But whatever may have been the land of its nativity, it may now be found in almost every country which is warm enough to ripen its beautiful fruit. Cultivation and climate modify it considerably. In China it is perhaps most skilfully managed, for we hear that the Mandarin orange is unequalled in flavour. In Northern Africa it is small and very sweet, and the rind has a most delicate perfume. In the rich soil of South America, again, it is more oval than round in its shape, attaining a very large size, and often producing some curious excrescences on the top of the fruit opposite to the stalk. The oranges which we see in our shops are produced chiefly in Italy, Spain, and Portugal, and grow in those parts of Southern Europe in such profusion as not only to yield an abundant supply to the inhabitants, but also to allow of their sending vast quantities to this and other countries. About 400,000 packages of oranges are annually imported into Great Britain, which, at 300 oranges per package, would give 120,000,000, and as they are rarely sold at less than a halfpenny each, the retail trade of the country in this fruit alone must reach the extent of £252,000 per annum. The rind of the orange is converted into a sweetmeat by being boiled in sugar until it is candied, and from the fresh rind a sweet-scented oil is made, which is used in perfumery. A still more agreeable oil, with which Eau de Cologne is perfumed, is distilled from the flowers of the tree. The orange-tree, like most of its tribe, bears ripe and unripe fruit and flowers at the same time.

2. *The Lemon, &c.*—The Lemon is produced by a tree which differs from the orange chiefly in the shape and colour of the fruit, which is oval in form, and has a small rounded projection at the top about the size and shape of the tips of our little fingers. Its colour is a pale yellow. It is too acid to be eaten as a table fruit, but a very agreeable drink is made from it, and its juice is very useful in curing or preventing the terrible disease called scurvy, which afflicts those who are obliged to live long on salt provisions. On this account it is now considered a necessary on ship-board. The lemon comes chiefly from Sicily, but we also receive small quantities from Spain and Portugal. There are several other fruits belonging to the orange tribe which are much valued in the countries to which they belong, and are occasionally seen in our markets.

For example, the rind of the Citron, the fruit itself being rarely imported fresh, is candied with sugar and sold in every grocer's and confectioner's shop. It is shaped like the lemon, but is much larger.

The Lime is a small roundish fruit, hardly half the size of an orange. It is imported only in a preserved state. The Forbidden Fruit and the Shaddock are two large orange-shaped West-Indian fruits, which are of a pale lemon colour, and grow occasionally to the size of a man's head. The Cumquat comes preserved from China ; it is about the size and shape of a damson, of a golden-yellow colour, and in flavour not unlike the candied citron-peel. The orange tribe, though, as we have seen, very important, on account of the number and utility of the fruits it produces, is by no means so valuable as—

3. *The Grape.*—The Vine may be ranked with the wheat and cotton plants in importance. It yields the luscious and cooling grape, which, if every quality be considered, is perhaps the finest of all known fruits, and from these are prepared the raisins and currants (different as they seem) sold by our grocers. The differences among grapes are caused chiefly by cultivation. For as soon as cultivators see a different kind appear, they encourage it, if it promises well. In this way the fine sun raisins of Malaga, the common raisins of Spain, the black, and the stoneless red Sultana raisins of Turkey, and the small stoneless black Corinth (or *currant* as we call it) grown in the islands of Greece, are all grapes raised from the seeds of the common vine.

Those called "raisins of the sun" are grapes dried in the open air, the finest of them whilst still hanging on the vines ; and in order to quicken this operation, the stalk by which the bunch hangs is partly cut through. In this way they are rapidly dried, without losing any of their fine flavour, or the beautiful bloom which covers them. The usual way, however, is to gather the grapes, and after having exposed them to the sun and air for some time, to lay them out in rooms, where they are sprinkled with water in which soda or potash has been dissolved. This causes the sugar of the grape to candy, and form those little lumps so well known as the sweetest parts of the common raisin, so frequently found in plum-puddings and cakes.

In addition to grapes and raisins, we are indebted to the vine for wine and brandy—two great blessings when properly used. Wine is the juice of the grape fermented, and kept with care.

Genuine Brandy is a spirit distilled from the husks which remain after the juice for making the wine has been pressed out.

4. *The Fig.*—The Fig is another important fruit which is sent to us in very large quantities from Turkey and Greece, those from the former country being of the best quality. After they have been gathered from the trees and dried in the sun, they are tightly packed in square or round wooden boxes, the latter usually called drums. The fig is used only for eating.

5. *Banana; Pomegranate; Pine-Apple.*—In tropical countries the Banana is a highly-prized fruit, for it is produced so abundantly, and is so wholesome, that it forms a valuable article of diet for both rich and poor. Sometimes huge bunches of it may be seen hanging in the fruit shops in our seaport towns, but these imported bananas are usually green and unripe. The fruit is about the size of a large pear, but differently shaped, several of them being arranged round a short stalk, like the fingers on the hand, and a number of these smaller bunches being in their turn clustered around a larger stalk: there are often a hundred bananas on one full-sized bunch.

The Pomegranate also is very highly valued in warm countries for the cooling juice it contains. In shape, it resembles a large apple, but the rind is as hard as the bark of a tree, though beautifully coloured like a rosy apple when ripe. When this hard rind is broken, it is found to be filled with a great number of berries, of the size and colour of our red currant, which they very much resemble; these are filled with a sweet juice, which is found to be particularly agreeable in hot climates, although it is not generally liked in this country. Pomegranates grow on small trees, like myrtles. The flower is of a fine scarlet colour, and the tree is consequently cultivated for its beautiful appearance, no less than for its fruit, in India, Northern Africa, and Southern Europe, particularly Italy and Spain.

The Pine-apple is a West Indian fruit, which has been introduced into all parts of the world, where it can be made to grow either by natural or artificial means; because, when well cultivated, it has a very delicious flavour. Owing to the introduction of steam navigation, vessels can now bring the pine-apple in a ripe state from the Bermuda Islands, where it grows naturally, and, with cultivation, attains very great perfection. It is consequently now sold in London and other large towns at a very cheap rate compared with the price demanded for those grown in our hot-houses.

6. *Nuts.*—The Hazel-nut, of which many thousands of bushels

are brought to this country from Spain, Sicily, Smyrna, and other places, is too well known to need description. The Walnut, too, is brought from foreign lands, chiefly from Germany, France, and Italy, though not in such large quantities as the common nut. Circassia is the country in which the walnut is most extensively cultivated. It is supposed to be the nut mentioned in Gen. xliii. 11.

The Hickory-nut and the Peccan-nut have kernels much like walnuts, although their shells differ considerably. They both come from the United States of America. The former has a hard smooth shell of a whitish colour, and is shaped very like the common walnut; the latter is darker in colour, and shaped like a filbert, though somewhat larger.

The Almond is the fruit of a beautiful tree, very much like our peach and nectarine. Its shell is covered with a hard green flesh, which makes it look, when growing, something like an unripe apricot; when fully ripe this green covering splits, and the almond in its rough shell drops out. There are three species: the Jordan almond, which has a long and narrow kernel; the Valencia almond, which is broader and shorter; and the bitter almond, which is much smaller than either of the two preceding, and very bitter to the taste. Almonds come from Spain, Italy, and France; but the last-mentioned species chiefly from Barbary in Northern Africa.

Those curious, brown, long, and three-cornered nuts which we so often see upon the fruit-stalls, and which are usually called Brazil nuts, but which are also called Para nuts, are the fruit of an enormous tree, one of the tallest and largest that grow in the forests of Brazil. This tree produces fruit as large as a child's head, which, when ripe, has a shell so hard as to require a heavy blow from a hammer to break it. Within this shell are found about twenty nuts, sweet to the taste, and, when eaten in moderate quantities, wholesome. More than 30,000 bushels are annually sent to this country, all of which are sold for eating.

The Cocoa-nut is familiar to all young people as the largest of edible nuts, and as containing a kernel somewhat like an egg in shape, lined with a solid white substance, holding a liquid called the milk. This large nut is the fruit of a Palm-tree, which may be described as a tree with a tall stem without branches, and bearing on its top an immense tuft of gigantic feather-shaped leaves. This palm grows by the sea-side in most tropical countries, and the fine kernel of the nut furnishes food to the inhabitants, who find it very wholesome. Large quantities of oil also are pressed from it after it has been ground into a rough sort of meal, called in Ceylon, *Coperah.* The large husk which surrounds the hard shell of the nut is broken up, and its fibres, when properly dressed, are called Coir, a substance much used for making ropes and mats, stuffing for cushions, &c.[1]

III.—FOREIGN SPICES.

Not satisfied with the simple food which has been provided for him, man has brought from all quarters the means of giving a higher flavour or more agreeable taste to what he eats. To those foreign vegetables which, in consequence of their specially agreeable flavours, are employed in improving the taste of our various kinds of food, we give the name of *Spices.* The name of *herbs* or *pot-herbs* is applied to those which are grown in our own gardens for similar purposes.

Cinnamon is the under-bark of the cinnamon laurel, a large bush which grows chiefly in the island of Ceylon. It is prepared as follows :—After the strongly grown young twigs have been cut off, the thin outer bark is removed ; the under bark, which is thicker, is then stripped off and dried. Whilst drying, several pieces are rolled together, so as to make sticks about a yard long. They have a peculiar reddish brown colour, and an agreeable, pungent flavour. The bark of another shrub called the Cassia laurel, is prepared exactly in the same way in China, and is called *Cassia* or *Cassia lignea.* It so closely resembles cinnamon in appearance, that it is frequently sold for it, but its worth is not a fourth of that of cinnamon. The former is imported in bales from Ceylon ; the latter, in chests, from China.

Cloves are the dried flower-buds of a small but handsome tree, originally a native of the Philippine Islands, but now cultivated both in the East and West Indies, and in South America. They are gathered just as they are nearly ready to open into flower, and are very carefully dried in the sun, by which they become hard, and take a deep brown colour. It is strange that the beautiful flavour of the clove should be found chiefly in the flower-buds, for it exists only very faintly when the flower is open, and almost entirely disappears in the fruit.

[1] Here, as elsewhere, home-produce and its uses are left to be supplied by the teacher and the pupil. A continuation of the lessons on native products, written by the pupils, would form a useful exercise.

The West Indies furnish us with another spice, which is known by various names, as *Allspice, Pimento*, and *Jamaica pepper*. This is the ripe berry of a small tree (Allspice tree), somewhat like the myrtle in its habit of growth. It is planted in rows, called Pimento-walks, and these plantations are very beautiful and productive. The berries are gathered and dried, which makes them turn brown, and they are then packed into bags, and sent to England and other countries.

But the most valuable of all the spice-trees is that which produces the *Nutmeg*. It is a native of Amboyna, and grows to the size of a small pear-tree. When in bloom its branches are quite loaded with a profusion of small pinkish flowers growing in bunches. The fruit, which, in size, shape, and colour, somewhat resembles a middle-sized pear, splits open when ripe, as if cut; and within it we may see the mace, which forms yellowish-red bands over a brown shell, in which is contained the kernel or nutmeg. This will be best understood by imagining a filbert-nut growing inside a pear, the mace being represented by the green husk which covers the nutshell. The peach also furnishes a good illustration: first there is the fleshy fruit; then the fibres which cling to and lie within the furrows on the "stone;" and lastly there is the stone enclosing the kernel. The shell which encloses the nutmeg is thin, brittle, and of a shining brown colour. The fleshy fruit is not often eaten, as it tastes somewhat like turpentine. The valuable parts are the mace, and the kernel or nutmeg, which are dried and preserved with great care, and packed into strong chests for export to various countries.

Ginger is the underground stem or root-stock of a dwarf plant, which, although a native of India, is now cultivated in most hot countries. When growing, it resembles a short reed, having a thin round stem and a few grass-like leaves. The root-stock or ginger is dug up and washed. It is yellowish-white in colour, and, when dried, has a dirty-white wrinkled skin. This is sometimes scraped off, and the ginger bleached, a process which makes it beautifully smooth and white, but does not improve its quality. We get ginger from the East and West Indies, and Western Africa. It is often preserved in sugar, the root being taken up when young, and boiled in syrup. Preserved ginger is sent to us from China and the East Indies: a little also comes from the West Indies.

Of *Pepper*, there are three kinds known in trade. The *black*, the *white*, and the *long*. The first two grow upon the same plant, which is a climber, and produces pretty bunches of bright berries, resembling those of our holly in size and colour, but arranged in close spikes, about an inch and a half long. These red berries, when gathered and dried, turn black, and the thin fleshy external part becomes wrinkled. They are then what we call pepper-corns and *black pepper*. In order to procure white pepper, these pepper-corns are soaked and put into rough bags; they are then violently shaken backward and forward, until the black wrinkled surface which has been softened by the soaking is rubbed off. The smooth white seed which remains is then dried and sold as white pepper.

Long pepper is very different in appearance, and is produced by another species of plant. It is white in colour, and composed of little sticks consisting of a number of small seeds packed very close together. Being expensive, it is not much used. The peppers originally came from India, but, like many other valuable plants, they have been carried by the industry of man to many parts of the world where the climate is favourable. We, however, get it chiefly from India. Cayenne pepper is not furnished by a species of pepper plant, but is made by grinding the large red pod-like berries of the Capsicum, which are extremely hot to the taste. It is made in the East and West Indies, and in South America, and is highly prized as an aid to digestion.

Many other things are used to give flavour to our food, such for example as Turmeric-root, which is, however, chiefly used in dyeing. Mustard and other stimulants find a place at our tables, but these do not come strictly under the head of spices. In addition to their agreeable flavour, spices have usually an equally pleasant smell, and are, consequently, often used in perfumery.

IV.—THE PLANTS WHICH FURNISH US WITH CLOTHING AND CORDAGE.

If we travel into various countries we shall notice some in which the crops are very different from those of our own land. Fields of golden corn we shall generally find, but we shall see it sometimes varied by the slender flax, which grows only about two feet high, and, when in bloom, makes the surface of the land look as sweetly blue as the sky above. In other places, again, the tall gloomy-looking hemp-plant, with its dark green but graceful foliage and sombre flowers, grows high enough to hide the labourers who till it. In more sunny climes the fields look like seas of gold and silver with the yellow flowers and snow-white seed-down of the cotton-plant; while, in other lands, the traveller gladly flies for shelter from the tropical sun to the beautiful groves of the fibre-producing plantain, or to plantations of the cocoa-nut palm. In the East Indies, again, he cannot fail to be struck with the vast extent occupied by the coarse, tall, weedy Jute-plant. Many equally novel and curious crops would meet our eyes in various parts of the world; but those which we have mentioned produce the chief materials from which we make our clothing and our cordage.

1. *Flax.*—The plant which we have first mentioned, the flax, is grown in Great Britain, especially in Ireland, but also, to a large extent, in France, Holland, Germany, Italy, Egypt, and India. It has always been of great importance to the human race. The stalk is long and slender, branching at the top, and bearing several beautiful light blue flowers, about the size of a large buttercup. These are succeeded by little round pods of seed, each about as large as a garden-pea, and containing several of the little flat brown seeds called *linseed*, from which we extract oil. The stalk is not more than half as thick as a wheaten straw, but very strong, because of the tough fibres which run through it from bottom to top. These fibres, when separated from the pith which is mixed with them, and the skin which covers them, are the flax from which linen is made. In order to obtain them, the plants have to be pulled up just after they have done flowering, and dried in the sun. Small bundles of them are then placed in the shallow part of a river or pond, stones or pieces of wood being placed to prevent them floating away. At other times they are simply exposed to the night-dew. The moisture which they thus imbibe quickly causes the soft skin which covers the fibres to decay.[1]

After this process is completed, the bundles are spread out to dry, and when dried, the whole stalk can be easily rubbed to a powder, with the exception of the fibres, which are not impaired by the process. The bundles are accordingly beaten with a heavy wooden implement, or *scutched*, as it is called; and to remove the skin and pith broken up by this process, they are next heckled,

[1] This process is called *retting* (water-retting or dew-retting, according to the process adopted), the word retting being a corruption of rotting.

or drawn through a peculiar kind of iron comb. The fibres which remain after these two operations are raw flax, and are fine enough for making coarse linen cloths; but they require to be *heckled* over and over again through much finer combs, to render them suitable for the manufacturing of fine linen, lawn, or lace.

2. *Hemp.*—The Hemp plant goes through a similar process, but is much coarser, and grows to a height of more than six feet. Great quantities are produced in Russia and Poland, and also, though not to the same extent, in Prussia, Germany, Austria, Italy, India, and the United States of America. It would be hard to say what we should do without this very useful plant, for, from the fibres of its stem, after they have been separated and cleaned by processes similar to those described in the case of flax, we make cloth for the sails of our ships, and ropes for their rigging; and although many substitutes have been proposed for it, none have been found to answer so well. In addition to sail-cloth and cordage, finer cloths and string of all kinds are made from it. Even when hempen ropes are worn out, they do not cease to be useful; for if they have been used for ships'-rigging, and soaked through with the tar which has been rubbed over them as a preservative, they may be untwisted, and the tarry hemp then forms what is called *oakum*,—a most useful material to the ship-carpenter, who stuffs it tightly in between the planks of ships to prevent leakage. If the ropes have not been soaked with tar, they are used for making brown paper. Coarse white paper is made from the bleached or whitened sail-cloth. The finest kinds of paper, however, are made of linen rags, and this is another important and highly interesting use of the flax-plant.

It is impossible to feel too grateful to the "Giver of all good things," for enabling man to discover that from two such humble plants, he can obtain the means of making fine linen to clothe himself with; thread for sewing his garments; lace for decorating rich dresses; sails to give wings to his ships and carry them to and fro across the widest seas, ropes for rigging his ships, and last, but not least, paper upon which he can write or print his thoughts, and spread them abroad for the benefit and instruction of his fellow-men.

3. *Cotton.*—The Cotton plant, as a means of obtaining clothing for the human race, is even more important than either flax or hemp: it is exceedingly handsome, somewhat larger than a goose-

berry-bush, bearing fine large flowers, generally yellow, and not unlike those of our garden Hollyhock. The plants are placed in the ground in rows, and carefully tended until they flower; the seeds being produced in pods about as large as a pigeon's egg. Each of these seeds is about the size of a small pea, of a dark brown colour, and covered all over with fine white hairs, sometimes more than an inch in length. They are packed so closely in the pod that they are not visible when it first opens at the season of its maturity. Gradually, however, the hairs begin to unfold and push their way out, until, like the down of the thistle, they are caught up by the wind and scattered abroad. The cultivator, however, interposes before their dispersion, and gathering them, sends them to mills, where, by means of machinery, the hairs (or cotton-wool) are separated from the seed, which is kept for sowing again, or for the manufacture of oil, and of oil-cake for cattle.

The cotton plant is cultivated with greatest success and most extensively in the United States and in India. Our greatest imports are received from those two countries, but we also obtain supplies from South America, the West Indies, Egypt, and Turkey. It is packed into bales containing about 400 lbs. each; and the quantity required by our manufacturers for making calicoes, cotton cloths, sewing-thread, lace, wadding, &c., is so enormous, that we import altogether, about 10 millions of hundredweights, or 1120 millions of pounds. Now when we consider that a quarter of a pound is a good crop for a single plant, and that we probably do not receive half of what is produced, it will give us some slight idea of the wonderful extent to which this plant is cultivated. No less interesting is it to reflect upon its value in furnishing employment; for not only does it occupy people in sowing the seed, tending the crop, gathering the wool, and preparing it for the market; but millions of persons are employed in spinning, weaving, and dyeing it; in making it up into garments and other useful articles, and in selling it in various ways. There are first the growers and dressers, then the packers and shippers; the sailors employed in bringing it from various countries; those employed in unloading the ships; the merchants who receive it; the brokers who sell it; the spinners and weavers who manufacture it; the dyers who dye it; the pressers and packers who prepare the printed cloths for the markets; those who sell them to the shops; and those who make them into the various articles of clothing. Thus these fine silky white hairs with which the Creator, in His wisdom and beneficence, has clothed the brown shell of the cotton seed, are, in consequence of their adaptability to supply human necessities, the means of giving occupation to millions of our fellow-creatures.

4. *Jute; Manilla Hemp; Cocoa.*—In India, there is a plant which, though only a few years since an almost unregarded weed, is now cultivated with great care and profit. It is a tall-growing plant, throwing up its green stems to a height of twelve or fifteen feet; and by treating it in a manner somewhat similar to the hemp and flax, a fibre is obtained, which, though not so strong and durable as that of these two plants, is yet very useful to man. It is called *Jute*, and is used for making coarse bagging, in which cotton, sugar, and various other commercial products are packed for shipment. The sacking-cloth made of it is called *Gunny*, and all the sugar, cotton, oil-seeds, dye-stuffs, rice, and other heavy products of India are sent to us in gunny-bags or bales. Great quantities of it also are imported into Britain to be used as the ground-work of cheap carpets and rugs; also for making sacking and other cheap materials. When wet, however, it quickly rots, and hence it cannot stand much exposure.

Again we find in almost all hot countries a species of plantain—a beautiful tree, about thirty feet high, without branches, but having a tuft of very large leaves at the top. These leaves have stalks as thick as a man's arm, and several feet in length, and when retted and beaten, they yield a fibre called Manilla Hemp, which is exceedingly strong, and answers admirably for making large ropes, though too coarse to be woven into cloths.

Within the last few years, too, the outer husk of the cocoa-nut has been made to yield a fibre, which the natives of India and Ceylon prepare and spin into yarn. This is woven into cloth for matting, or made into large ropes for ships: it is called by its native name, Coir, and is now extensively used in this country for ropes, door-mats, floor-matting, brushes, and stuffing for cushions.

We have now given some account of the vegetable food of man, and of the principal materials with which the vegetable kingdom furnishes him for making Clothing and Cordage; and although little has been said of them, the slightest reflection will show us how many blessings we derive from a knowledge of the properties and uses of the various products of the soil. None of the plants we have spoken about are attractive in appearance, compared with the gorgeous plants with which we beautify our gardens; and in this respect they teach us not to overvalue mere external beauty, or despise anything, however humble, which God has in His wisdom created.

V.—THE PLANTS USED IN DYEING.

The clothing with which the plants of which we have been speaking furnish us, when not naturally white like the cotton plant, become so under the process of bleaching and washing. A moment's reflection will satisfy you how disagreeable it would be to us if we had no means of varying this colour. God has covered the earth with beauty: He has profusely decorated its surface with flowers of every imaginable shade of colour; and He has given us eyes to see, and minds to appreciate the glorious hues of the sun-lit clouds, the empurpled mountains, and the green carpet of the earth. He has striped the tiger and the zebra: He has spotted the leopard: He has clothed the birds of the air with every variety of splendour, from the wondrous plumage of the peacock to the dazzling little vest of the humming-bird. The shells of the sea-shore are painted with daintiest care. Countless insects flutter like moving flowers, rivalling in beauty those over which they hover, or they move majestically along, glittering in burnished coats of mail, outshining the emerald and the ruby in the dazzling brilliancy of their hues. We see all these things, and when our eyes are trained to look lovingly on the works of God, they are a joy to us, and a never-ending pleasure. Having then this capacity of enjoying colour, how painful it would be to us if we were compelled to wear garments always of one hue, either of the undyed vegetable fibres, or of the uncoloured sheep's-wool of which our woollen cloths are made! Happily the Creator, who has made all these things for our use, has gifted us with intellect and an ardent desire for knowledge, which are ever leading us on to explore the world, and to examine carefully all created objects; and by the exercise of this intelligence, man has found out ways of transferring the colours of plants to his woven cloth. When he found that these colours faded too speedily, his busy mind would not rest until, by experiments, patiently and perseveringly conducted, he discovered the means of rendering them permanent. But all this has not been done at once ; century after century the search into the properties of things, as well as into the laws of nature, has been prosecuted, and even now, apart altogether from the love of knowledge for its own sake, our wants, as civilized men, require constant efforts of thought, if we would add beauty and variety to our manufactures.

1. *Logwood.*—One of the principal of our dye-stuffs is logwood, which is imported in the form of large rough blocks of a dark-red coloured wood. They are pieces of the stem of a very fine large tree, which grows in the forests of South America, particularly about Honduras. When boiled in water, this wood communicates to the water its own dark-red colour ; and if a few drops of vinegar, or any other acid, be added, the red acquires a very bright hue. Red ink is made in this way, but it requires the addition of a little alum, or some other chemical substance to render it permanent. If instead of the acid, we put a little soda or potash into the water, it gives rise to a dark blue or purple ; and by careful management, it may be made to give nearly every shade of these colours. This wood is very hard, and is cut into blocks with great difficulty. After these blocks are brought to this country, they are cut up or rasped very fine, in powerful mills constructed for the purpose. So much is this wood used by our dyers, that our ships annually import from South America about 40,000 tons.[1]

2. *Nicaragua Wood, &c.*—Another dye, called Nicaragua wood, comes over in somewhat similar blocks. It gets its name from the fact of its being chiefly procured from the Republic of Nicaragua, in South America. This wood yields to the dyer delicate peach and cherry colours. That which is brought from Peru, however (called Lima wood, from the port at which it is shipped), yields finer shades. The inhabitants of those countries send us yearly more than 8000 tons of this wood. Two others are also sent from Brazil, but in much thinner pieces, and of lighter colour, owing to the outer part of the wood being yellowish. The inside, however, is red, like the woods of Nicaragua and Lima. One is called Brazil wood, the other, Braziletto ; the latter being in

[1] When it was first brought over in Queen Elizabeth's time, this wood obtained such a bad character, owing to the ignorance and dishonesty of the dyers, that an Act of Parliament was passed to prevent its being used. Cloths were dyed with it, but the mode of fixing the colours being unknown, purchasers were disappointed at finding that they washed out. This raised a great outcry against the dyers who had sold them as *fast colours.* But in the course of time discoveries were made, which removed the difficulty, and logwood is now considered our most valuable dye-wood

pieces about the thickness of a man's wrist, the former as thick as the arm. These yield some very delicate tints of rose, lilac, and other hues. The vast forests of South America are very rich in useful plants, particularly in those suitable for dyeing.

In addition to those mentioned, we have blocks of wood sent to us of an orange yellow colour, evidently parts of the stems of very large trees. This is called Fustic, and is used for dyeing various shades of yellow and brown. This, too, is very extensively used, and our dyers now consume fully 10,000 tons annually.

3. *Madder.*—There is a little creeping plant called Madder, which is very common in the warmer parts of Europe and Asia, not only as a cultivated crop, but also as a weed. It is cultivated, to some extent, in Holland and Germany, and forms a very considerable article of trade. Its roots, which are about as thick as a black-lead pencil, and of a blood-red colour, are dug up and carefully dried, and packed into bags or bales for exportation : if ground before being sent to market, the powder is packed in very large casks. So important is madder, that it is extensively cultivated in almost every country suitable to its growth : we get madder roots whole from India, Turkey, Greece, Spain, and France ; and *ground madders*, or madder roots reduced to a coarse powder, from Holland and Germany. The natural colour of the powder is the bright red, called Turkey red, but by the addition of various chemical compounds, almost every shade of red, purplish brown, purple, lilac, and even a lively rose colour, can be procured from it. It is so extensively used, that it employs many thousands of people in Glasgow, Manchester, and other large cotton-manufacturing towns, and scarcely a calico or muslin print is made without the aid of madder-root in some way or other for forming the pattern. Nearly 20,000 tons are used every year in this country alone, and it is also one of the principal dyes used in India, Turkey, and elsewhere. We thus see that the importance of this weed, humble as it appears, and which, if growing by the hedge-side, would scarcely attract a passing glance, can scarcely be overrated. Indeed, it is estimated that, in 1856, the manufacturers of Great Britain paid the merchants of other countries no less than £988,574 for this root alone in one form or other. What a lesson this teaches us ! The gaudy tulip will catch the eye, and call forth the praises of the uninstructed child ; but he who has learned that genuine worth is a higher quality, will rather be disposed to look with admira-

tion upon this unattractive little weed, which is so useful to man, and affords employment to so many thousands of our fellow-creatures.

4. *Indigo.*—In India, in Egypt, and in Brazil, immense fields are covered with crops of a plant called indigo, somewhat like the tare of our farm-lands, but more erect and slender. It bears its little pea-shaped flowers in clusters, and though smaller, has a great resemblance to the pretty blue vetch which rambles through our hedges. When this plant is about to blossom, it is cut down and tied in bundles, which are quickly carried to large cisterns before the sun has time to wither them. When the cistern is nearly full, weights are placed on the bundles to keep them from floating, and water is let in until the indigo plants are completely covered. After the plants have been for some time infused, the water becomes yellow, and is drawn off into another cistern, and fresh water continues to be added until the plants cease to give it a yellow tinge. The yellow water is then beaten with poles, and violently stirred about; an operation which, by causing the air to mix with it, changes the yellow to a deep blue, just as contact with the air changes the bitten part of an apple to a brown colour. The blue is heavier than the yellow, in consequence of the air which has been intermixed, and it consequently sinks when left at rest, depositing itself at the bottom in the form of a blue sediment. The water is then drawn off, and the sediment, which has solidified in the process of drying, is cut out in little square blocks, which, when perfectly free from moisture, constitute the Indigo of commerce. These blocks are packed into strong chests, and sent to this country, where indigo forms a most valuable addition to our dye-stuffs, giving various shades of blue and violet, and, when mixed in proper proportions with yellow, almost every shade of green. It is an expensive article, being worth from three to five shillings per pound; nevertheless, we use more than 2000 tons, or 4,480,000 pounds of it annually.

5. *Safflower.*—Another very important plant to the dyer is the safflower, which, in the colour of its flowers, and the size of the plant, is like our garden marigold. A safflower field in full bloom must be exceedingly beautiful, and like a sea of gold. When in full blossom the harvest begins, the gatherers plucking the flowers, and pulling out their bright orange-red petals. These are then pressed into little cakes and dried, and sent from India to Europe packed in strong bales. There are two distinct colours in safflower, a bright crimson and a fine dark yellow which can be separated by the

chemist's art so as to be used, either singly or together, as the dyer wishes. This characteristic is not peculiar to safflower, for the same may be said of madder, which contains a mixture of bright red and purple : several other plants have more than one colouring principle. The crimson colouring material of safflower, called *Carthamine*, is very peculiar, for, when in any considerable quantity, and dry, its surface assumes a peculiar metallic brilliancy and *green* hue, exactly similar to the burnished green of the wing-cases of Rose-beetles. It is a very expensive material, and is used only in dyeing fine silks.

Were we to visit a dye-house, we should find very many other dyes used, according to the material to be coloured, the quality of the colour required, and various other circumstances. But we have now enumerated the principal vegetable dyes, and have shown how the wood of trees, the roots of weeds, the petals of flowers, and the colouring matter of other parts of plants may be turned to many useful purposes, at the same time that they give the means of procuring profitable employment to many thousands of clever and industrious people.

VI.—THE MATERIALS USED FOR TANNING OR CONVERTING THE SKINS OF ANIMALS INTO LEATHER.

Man in a savage state is content to clothe himself with the dried skins of the beasts which he kills for food ; but it is one of the first steps in human progress to seek a more agreeable covering, and this man finds chiefly in those vegetable fibres which we described in a former lesson. Skins, however, continued to be used for many purposes for which they were peculiarly suited ; and, as mankind increased, the demand must have been so much extended, as to render it necessary to find some means of preserving the skins in such a way as to enable them to resist the action of damp and moth, which otherwise speedily attack and destroy them. This object is attained by *tanning* the skins, a process which we will endeavour to explain.

In the bark of certain trees, and in various plants, there is found a peculiar yellow substance called *Tannin*, very light, and of a bright shining appearance, in consequence of its being composed of small yellow crystals. This substance has the power of uniting with the skins of animals, and in this way of so entirely altering their nature, that neither will the moth touch, nor water rot them. To facilitate this union, the skins are placed in pits with large quantities of bark containing the necessary *tannin*,—water also being largely added to dissolve it. After lying a considerable time, the skin takes up a sufficient quantity of the tannin, and becomes Leather.

The most valuable bark for this purpose in our own country, is that of the oak. The Dutch and Belgians also send us very large quantities of oak bark, which is stripped from the trees when they are felled for their timber, and chopped into small pieces. We also use the bark of the larch tree, but it is not so powerful an agent as that of the oak.

In Turkey, they have a very small oak, which, though not growing larger than an elder-bush, produces large acorns, the cups of which are extremely curious, on account of their being covered over with woody scales. These cups are much prized by tanners, and our merchants import very large quantities under the name of *Valonia*.[1] The shells of the pomegranate fruit have also the property of tanning, and in Barbary, they are used for making the celebrated Morocco leather. In Russia, the bark of the birch is employed, and owing to its containing a strongly scented oil, the leather made with it always possesses an agreeable smell.

From South America we obtain, in vast quantities, a curious brown seed-pod, which is of great use to the tanners. It is somewhat like a pea, but bent in the form of the letter S, of a dark-brown colour, and goes by the name of *Divi Divi*, a name which it probably received from the Indians, but which our merchants have adopted.

The Cork-tree-oak bark also is sent from Northern Africa, Acacia bark from India, and Mangrove bark from Sierra Leone, all to be used in tanning. But the most important of all the substances imported for this purpose is Catechu, which is made by cutting up the wood of a certain species of Acacia into chips, and boiling it until it makes the water a dark-brown colour; then straining off the water from the chips, and boiling it by itself, until nothing remains except the brown colouring matter, which soon becomes hard and brittle. Having been packed in mats, it

[1] Sometimes they are gathered when very young, and not fully formed; they are then called *Camata* or *Camatina*. In this state they are more valuable, but too expensive to be much used.

is sent from the East Indies to this country in very large quantities. This material is differently prepared in different parts of India, and, consequently, there are several sorts, known to our merchants by the names of Catechu, Terra Japonica, Cutch, and Gambier. These materials, being easily dissolved in water, tan skins very rapidly; but the leather is not so good or durable as that which is more slowly prepared by oak-bark.

A kind of fruit, not unlike a large acorn, but wrinkled instead of smooth, is also imported from India, to be used in our tan-pits, as well as in our dyeing-vats. It is called Myrobalan. The best Myrobalans are gathered before they are ripe, and they become wrinkled in drying.

All these materials derive their value from the fact that they contain the substance called tannin, and from the power which it has to unite with the animal skin, and thus form leather. Leather is thus a chemical compound, formed by the union of tannin with that part of the skin which is called albumen (which we see nearly pure, and in a hardened state in our finger nails), and, accordingly, if we were to use chemical language in describing leather, we should call it *tannate* of *albumen.*

VII.—ON THE MATERIALS USED FOR PERFUMERY.

The exquisite pleasure we enjoy from the smell of sweet flowers is alone sufficient to account for the love of perfumery. Flowers pass away so quickly, that we naturally desire to preserve their sweetness as long as we can, and in accomplishing this, our perfumers succeed admirably. It happens that the perfume of most flowers depends upon the presence of an oil, which is peculiar to the plant, almost every sweet-scented plant having its own particular oil: and what is of more importance, these oils belong to a class called *essential* or *volatile,* because they become volatile, or evaporate, when heated. The common or fixed oils, on the contrary, such as olive or linseed, will not evaporate. This may be easily illustrated, thus: if a piece of writing-paper be touched with a fixed oil, or grease, it leaves a stain, which, if held to the fire, remains not only permanent, but spreads considerably. If, however, the paper is touched with an essential oil, it will make a similar stain, which, upon being held before the fire, will disappear altogether. Now, if any plant has a particular smell or taste, it is generally found that its essential oil is the cause of this; and that, consequently, if we extract this we really obtain the essence. For instance, if we distil the herb known as peppermint, we obtain an essential oil, which both smells and tastes of peppermint, and thus we can retain, as long as we please, the essential principle which made the herb valuable to us, whereas the herb itself grows up, and perishes within a year.

The general method used for obtaining the essential oil is to put the leaves, flowers, or other parts of the plant, the perfume of which we wish to obtain, into a large distilling apparatus, mixing them with water. When the water boils, the steam which passes off contains portions of the volatile oil. This steam is then condensed, or re-converted into a liquid, by being passed in pipes through cold water. The water, thus condensed from the steam, has the essential oil floating on it, as a greasy film gradually increasing in quantity. This is skimmed off, and afterwards purified by filtering. Sometimes, if the vegetable material from which the oil has to be extracted is very perishable, salt is added, which does not affect the oil.

In this way we distil perfumed essential oils from—

The flowers of the Rose.
The flowers of the Lavender plant.
The leaves, rind, and flowers of the Orange and Lemon.
The leaves of the Rosemary.
The rind of the Bergamot Orange.
The spices called Cloves, Allspice, Nutmeg, Cinnamon, Cassia, and various other materials.

That from the Rose is called Attar, Utter, or Otto of Roses.

Herbs also, when properly dried, are used in perfumery: for instance, the roots of a species of Iris are prepared, and sold under the name of Orrice-root, and are used to give the odour of violets, which they possess in great strength. The shavings and sawdust of sandal-wood, a beautiful perfumed wood which comes from India, are often used.[1] The leaves of an Indian plant yield the curious perfume called Patchouli, and the South American seed called Tonquin or Tonka-bean is used by tobacconists for scenting snuffs.

The gums yielded by some plants are also used in perfumery, as

[1] The root of an Indian grass is sold under the name of Khus-Khus, and has nearly the same odour as the sandal wood.

Gum Benzoin, also called Benjamin, Gum Myrrh, and a few others.

The usual method of using these materials is to put them in very pure and scentless spirit. Spirit of wine or alcohol is employed for this purpose, and as it dissolves the essential oils and gums, and takes up their perfumes, it is well adapted for the purpose. Thus, Lavender Water, as it is called, is merely a spirit scented with various perfumes, of which oil of lavender is the principal.

There are also two or three substances used in perfumery which we obtain from animals, as Musk, Civet, and Ambergris, but these belong to another branch of economic science.

The oily character of most perfumes enables us to scent oils, pomades, &c., in great perfection. Indeed, oils so readily take up the perfume of plants, that they become scented merely by having the flowers placed near them, and this method is employed where the true essence cannot be obtained by simple distilling. Orange and jessamine flowers, for instance, are often placed between pieces of cotton-wool soaked in oil; in a short time the oil becomes strongly scented, and answers well for hair-oils and pomatums.

LESSONS ON SOCIAL ECONOMY.

1. *Schoolmaster.* I want to engage you boys on a new subject: I want you to begin the study of Social Economy, a branch of Social Science.

A Boy. Social economy! What *is* social economy? what is the *use* of it to me?

S. I am glad you ask me these questions, for a boy ought, before he gives up any considerable portion of his school-time to a new subject, to ascertain, as well as he can, both what it is he is about to work at, and that his work is likely to make him, in all respects, a more useful—a better man. But I cannot make my answer very short. If you will think along with me for a moment you will see that I cannot. Suppose some little boy who had not had the advantage of instruction in arithmetic, were to hear that you are learning at school to work Proportion. He would like to understand what Proportion is; and you, if your school-training have rightly moulded your character, as well as informed your mind, will be willing and anxious to give him such an answer as he can understand. You, possibly, if your schoolmaster asked the question, could promptly give *him* the short and proper answer, which your text-books of arithmetic and algebra contain. But to your little untaught acquaintance, when he says seriously to you, as if he had full trust both in your knowledge and your kindness, "What *is* Proportion, and what's the *good* of it?" the answer which well pleased your schoolmaster would be useless. If you would really give him help you must be at some pains, first of all, to find out what he *does* know, and then, by adapting your teaching to his knowledge, to lead him to discover what as yet he *does not* know. And some such course I must take with you, hoping that you will show me that attention and patience which you would like your young friend to show you.

Thus much I shall take for granted: you have not reached that class in your school in which this reading book is used, without having had your thoughts turned towards the path in life you mean to tread when you leave school. You have, I hope, felt that delight which knowledge fairly brings with it. You have learned, we hope, to esteem your schoolmaster, and have won his affection. You have sometimes noticed children who have been neglected, whilst you have been cared for. You have been warned against associating with them. You have heard, perhaps, of a boy of your own age being taken before a magistrate and convicted of theft. You have heard your father express his fears of that boy's future course, and his indignation at the neglect with which the little culprit's parents have reared him. And at such a time, thinking over what your parents have done for you, and what, in consequence, *ought* to be your course in life, you have made brave resolves to honour your father and your mother by your walk and conversation amongst men. You would like, when you become a man, to be a good and useful man.

Here, then, the teacher of social science joins you. He rejoices at your disposition, and desires to aid you in carrying out your good intentions. He feels that one branch of his science will be of great use to you; that branch which is called Social Economy, or economic science. Let us see now, if taking upon myself the office of teacher, I can manage to give you an intelligible account of what this science *is*. If I can make the account intelligible, I am sure you will find it interesting and alluring.

In the newspaper lying by my side, a little paragraph says, that the introduction of a machine for making boot-tops, has considerably alarmed the work-people who are engaged in the boot and shoe trade; and that the work-people of Stafford, to the number of 2000, have held a meeting in the new-covered market, and resolved that they will not make up boots for any master who makes the tops by machinery.

A master addressed them, urging, that although the introduction of the machine would throw some of them out of work, it was in vain for them to oppose the progress of machinery; that if they persisted in their opposition, they would ruin the trade of the town, because purchasers would go where the machines were used; that the best thing the working people could do would be to work *with* the machine instead of resisting it.

The work-people seem to have listened quietly and patiently; but they in their turn urged that the machines would throw their wives and children out of employment, and so, says the report, "A resolution pledging those present not to make up any machine-bound tops was passed by acclamation, and without a dissentient hand."

Now the master admits that the machine will throw some hands out of employment: *ought* he then to introduce the machine?

But, he says, purchasers will go where the machine is used; for there the boots will be cheaper: *ought* purchasers to go where the machine is used, and where, as they thoroughly believe, it has thrown the wives and children of the workmen out of employment?

The work-people asserting that the machine will throw their wives and children out of work, are trying to *force* the masters to keep out the machine; *can* they force the masters to keep it out? *ought* they to force them if they could?

If instead of *forcing* their masters the work-people could *persuade* them to keep out the machine, *would* it be kept out?

If kept out, would the work-people be *benefited?* would *any one else* be benefited? Would any one else be *damaged?* Would wages be altered by its introduction? If altered, how? would they be higher or lower?

On the subject which I have brought before you I might ask more questions, and very important questions too. But you are already puzzled. Even where you give an answer to yourself as we go along, you feel a little doubtful. Now my object is not merely to puzzle you. I want you to observe how men, who are doing the work of life, and, in most respects, are doing it well, get into conflict where they do not desire strife, and when engaged in the conflict, are without the power of guiding themselves to a right issue. And you, when you get to work, will find life putting just such questions to you. For instance, as soon as you begin work you will handle tools. A very probable result of the school-training which your parents have given you will be, that using an unhandy tool, you will wish to make it better; you will study how the improvement can be brought about, and likely enough you will succeed. But a tool is an instrument for diminishing labour, or (if this expression be more intelligible to you) is an instrument for making the same quantity of human labour produce more for our use, and a machine is only a more complex tool. Should some workmen check you in your efforts after improvement, by saying, "Do you want to throw people out of work?" How would you answer him? Or rather (for so the teacher of economic science loves to put his questions), if you, as a reflecting lad, should ask yourself the question, how would you answer yourself? Two courses would be open to you; one, that you should delude yourself by foolish answers, and so stifle your disposition to inquire. The other would be, that you should give the *right* answer, and so be stimulated to inquire at all times for the right course of action. But these questions are questions in social economy. To answer them intelligently you must study social economy—you must attain the *knowledge* which that science teaches. And notice here, I have emphasized the word "knowledge." My reason is this. All men have in their heads some sort of social economy; but, as a rule, it is a bad sort. So little do its possessors themselves esteem it, that they call their notions on the subjects on which I have questioned you, "*opinions*." You, if you be in earnest, will not be content with having opinions on such matters, you will get *knowledge;* yet that is the power of demonstrating to yourself, or to any capable and dispassionate reasoner, the truth of each answer you give to the above questions, just as you would demonstrate the truth of a rule in arithmetic, or of a theorem in geometry.

Boy. But how can I get that knowledge?

S. Patience. Before I close my lesson I will show you how; but at present I have your former question still to answer. I have turned your attention to one only of the great divisions of economic science. Let us now go to another, taking care to select again from life, and from one of those scenes of life in which, one day, it is more than probable you will find yourself.

2. Turning then to the newspaper again, I see that many colliers of the midland counties of England are "out on strike." The men seem to be, on the whole, orderly and well-behaved men. They hold meetings and manage their conferences with at least as much decorum as would be found in a meeting of gentlemen gathered together to entertain the member of Parliament for their borough, and to hear his political opinions. They have their solicitor, whom they have chosen for his skill, attending their

greater meetings, to warn them against any breach of the law. They are, in short, whether right or wrong in their *social economy*, acting like earnest, well-conducted men, who believe they are right. Their tale is this: "The masters want to reduce our wages fifteen per cent. It's a shame. We won't submit to it. Our wages are already too low to enable us to keep our families in comfort. Let us strike—*i. e.*, all of us at once and together leave off work—that we may *force* the masters to keep up wages to the old rate. And whilst we are out of work 'on strike,' let our brother workmen, who get the old rate of wages still, subscribe to support us, and let our brother workmen of other counties, who are threatened with the reduction, join us in striking against the masters."

What shall we say to this? You intend to become a workman, listen to some of the questions arising out of this dispute.

Ought masters ever, under any circumstances, to lower wages?

Can we, with truth and intelligence, say that *masters* have *the power* either to raise or to lower wages?

Have *workmen the power*, at any time, to fix or to raise wages?

At a time when wages cannot be raised by any other means, can "*a strike*" *raise* them?

May it at such a time *lower* them?

If, instead of trying to *force* masters, the miners were to succeed in *persuading* them to raise the rate of wages, when, but for the persuasion, wages would remain at the old rate, *could* the masters really raise wages?

If the colliers and their masters, full of good feeling for each other, were to make an effort to raise wages, by the masters paying and the men receiving a higher rate of wages for a time than would otherwise have been paid and received, how would *other* workmen's wages be affected?

For instance, the working shoemakers, the working stockingers, the working iron-makers, the farmers' labourers—the men who happen to consume some of the coal which the colliers produce,—would *their* wages be affected by the new arrangement? And if affected, how? Raised or lowered?

Such, you see, are some of the questions which the daily work of life is putting to each of us, and putting with a most importunate demand, for the *right* answer to each worker for wages. Such are some of the questions which the work of life will put to *you*, not as I am now putting them to you, when you have leisure for examining the facts, and coolness of head for detecting the truth; but will put to you, when you are in the heat of work, and when your passions are aroused by your actually being involved in the turmoil. The man, much older than yourself, who has been busy organizing the strike, will come to you with all the energy of which he is master, and with all the influence which his character for sobriety, kindness, and superior skill in his trade has given him; will urge you to join the strike, to help your fellow-workmen to redress their wrongs, to beard the tyrant capital into justice, and will perhaps, should you hesitate to surrender to his guidance, ply you thus: "What! do *you* fear the rich man's frown?" "Well, stay. He'll make you his foreman when there is an opening." "Are *you* coward enough to tremble at the prospect of a little suffering, of bread without butter, of potatoes without meat, for a few weeks?" "Well, stay. I'm *a man*. I will stand by my order. I will see my mates righted. I'll sell my furniture, my clothes, my books. I'll take my children from school, the boy shall run errands, the girl get some place, but I'll not desert my colours. I say *I* am a man. But you: oh, you had better stay! We want no half-hearted fellow to encumber our struggle." Through such scenes as these, at some time or other in your working career, you may have to pass. Suppose the study in which I am trying to engage you should lead you to know that strikes are wrong, that they may and do often lower wages, but can never raise them, would not you be glad to meet your tempter armed with such knowledge?

B. Yes. But are strikes wrong? I have heard my father say that capitalists and their foremen are often very tyrannical to their work-people, and although I know he is sorry when a strike takes place in his business, yet he subscribes to help the workmen who are out of work.

S. Whether we ought to say strikes are wrong, is a question we must defer until our lesson on "wages." All I wish at present, is to show you that this serious question will certainly concern you, and that to give it a *right* answer, you must enter on the study of social economy. The wages question is one of the most serious that engages the attention of the student of social economy, and is one that every worker for wages ought thoroughly to understand. You, I see by your remark, have been thinking about it; what I desire of you in our future lesson is, that you shall so think as to get for yourself rules of self-guidance concerning it.

3. The two instances I have put before you, in order that you may discover for yourself what kind of questions they are with which social economy concerns itself, I have taken, as you see, from the newspaper of the day—from life. The instances I am now going with much more brevity to cite, shall be taken from the same source, and although they may, perhaps, seem to you less important, I feel sure you will think them very interesting.

See ! in the newspaper, there is a column headed "Money Market and City Intelligence." It is printed in large type, and is evidently regarded by the editor of the paper as a very important part of his journal. Read it. Do you think you understand it ?

B. No, I do not ; or at least, not much of it.

S. Well, you need not be ashamed to confess you do not. Many a man who is neither uninquisitive nor dull, understands it quite as little as you do. But let me ask a few questions about it just for the purpose of making clear to you how little you understand of it. You will be all the wiser for recognising your ignorance where you are ignorant, and all the more disposed to get knowledge.

In the article the fluctuations of the prices of stocks are given. What are stocks ?

B. In my arithmetic book, it is said, "Stocks are Public Funds."

S. Do you know what public funds are ?

B. Not exactly.

S. Then your book, you see, has done, what school-books often do, given you one name for another, the second needing explanation quite as much as the first. But I need not inquire if you know the causes of the fluctuations in the prices of stocks or public funds ?

B. No, I can not tell.

S. A little farther on the writer of the article chronicles that £40,000 in bar gold has been taken to the Bank to-day, and that of the gold brought by the West India steamer, £22,000 consists of sovereigns, which will probably be taken to the Bank ; and in the money market article of a newspaper a few days old, it is stated that a large sum in gold has been taken *from* the Bank :

can you tell me what useful purposes to us all are served by gold being thus taken to and from the Bank?

B. No, I cannot.

S. You referred just now to your text-book of arithmetic. In it you have a rule called Exchange; and the article before says, "In foreign exchanges, this afternoon, the rates were the same as last post." What causes fluctuations in the rates of exchange?

B. Monies of different countries are different.

S. True, but the differences do not fluctuate, why do the rates?

B. I do not know.

S. At the end of the article we have been reading is the weekly account of the Bank of England. Would not you be glad to understand that statement; to know exactly what a bank is, what services it performs for the community, and how its managers are rewarded for those services?

B. Yes, I should.

S. Well then, here are some more of the subjects with which social economy concerns itself. To be intelligent on these matters you must study social economy.

And now, one other instance, as a foretaste of what social economy *is*, and then we will have some lessons in which you shall question me on the very points on which I have been puzzling you.

4. We will turn to the paper, or (as I do not intend to confine myself to one day's news) to the papers. Under the head "Police" we find magistrates continually acknowledging donations they have received, not for themselves, but for certain charitable purposes. Sometimes these donations are for the "poor-box"—a fund from which the magistrate may relieve the necessitous according to the measure of their need, and the extent of the fund at his disposal. But frequently these gifts take another shape. Some dreadful case of distress is brought before the court, the sufferer not infrequently being a woman—perhaps a mother with young children. The case is published. People read, and are shocked, and to relieve this special case, they send the subscriptions which we see thus acknowledged.

It is very noteworthy that almost all the subscribers keep back their names. They call themselves A. B. or Y. Z. as may happen; but plainly they wish to relieve suffering, and not to attract applause. Now, thankfully recognising the good feeling, one cannot but reflect how much better it would have been, if they who have the means could have given relief before the sufferer had become a public spectacle; how much better it had been to prevent the distress than to relieve it.

B. But can distress be prevented?

S. Ah! there you ask me one of the most serious questions in social science. Let me delay my answer; but, at the same time, let me urge you to delay yours. Do not, I beseech you, conclude that of the distress which pains our feelings and disgraces us as a nation, a large part at least is not preventible; for how do you know, until your economic studies have unfolded to you the *causes* of this distress, but what an earnest and intelligent people as charitable as those we live amongst, may find it *easier* to prevent than to relieve? But whatever decision we may come to on this matter, as the result of a future lesson, it is necessary now to point out to you that such questions as, "How ought we to use our wealth, so that, as far as possible, we may prevent destitution, instead of waiting for the destitution to come, that we may then relieve?" "How, when destitution has come, and must be relieved, shall we use our wealth in relieving it, so as to avoid encouraging the growth of the causes of destitution?" are questions in economic science, and can be *rightly* answered only by him who has studied social economy.

And to bring these illustrations to bear upon yourself; you, if your future course accord with the promise of your boyhood, will soon earn enough to be self-dependent. With both yourself and your parents that time will be an epoch in your life. "*I am now a made man for life!*" exclaimed George Stephenson to his mates as he came out of the foreman's office, on that Saturday night, on which he first received 12s. for his week's wages, and we can easily fancy how his father and mother both rejoiced over their son, at the moment when he brought home the news, that he had at length achieved for himself a man's standing in the ranks of the industrious. Well, like him, you, I doubt not, will strive and will win your post of honour, and feel a son's delight as you set home rejoicing. I dare trust you for this. Schoolboys of your class are not afraid of work. They rather look towards it as a step on and up in life, and right it is they should do so. But then life will put a very serious question to you. How will you use your earnings? Allured by your companions into the habits of wastefulness, which disgrace so many workmen, will you spend *all?* Or, guided by the knowledge which your economic studies have given you, will you as a religious duty *habitually save some?*

Trace now the effect of your choice, and, whilst tracing it, note how you are getting one answer, at least, to your question, "What is the *use* of social economy to *me?*" I pass over the duty of providing for yourself when out of work, when you may be sick, when you shall have become old. You have perhaps seen, at a time when distress reigned amongst the thriftless of your neighbours, your father fall back on his savings'-bank account as a means of driving distress away from his children, and of saving his home and yours from the brand of pauperism. If you have seen this, I may safely pass on; for in the manly virtue of self-dependence, you have had a more convincing lesson than I could give you, and have had your lesson from a better teacher to you than I can ever become; and you *will save.* But if you do habitually save, you will win for yourself a character both with your master and your fellow-workmen, from which these two things will certainly follow; you will raise your wages, and increase your influence—an influence which the instruction I am offering will enable you to use for great good. The second of these two consequences is the more important, and is the one which chiefly concerns us in this lesson; but (if, determining to examine the truth of the first statement, when in our lesson on wages, I proceed to a full demonstration of it, you will reason on it at present as true), I may point out to you, that from both causes—from your habit of saving, and from your improved wages, you will derive the means of helping others. When, as happens with a most lamentable frequency among work-people, the begging petition of the sick or distressed workman, telling his tale of woe, is handed round from bench to bench in the workshop, and the prodigal of the shop winces at the gift which the public opinion of his mates forbids him to withhold, and his own bad habits make it hard for him to spare, you will be able like a man to do your duty in the relief of suffering, and to make your gift an ungrudging one. Don't forget at such a time to do, what intelligent reflection on the case shows you is your duty, in a generous spirit. Your generosity will be welcome, indeed, to the sufferer; will make you in your moments of self-examination a happier man, and will increase that influence for good of which I am now to speak.

Amongst workmen, wherever they are gathered together in numbers, you will find some efforts being made to provide against suffering, and you will be asked to help in them. You will soon detect how feeble, and how frequently misdirected, such efforts are. You will see, in the small payment to the sick club, an inadequate provision for sickness, and the many offences it brings with it, and you will see, in the public-house habits which the club-meetings encourage, the name of prudence made a cover for debasing wastefulness.

Would you like to cure, or if you may not wholly cure, seriously to check these evils? Then you must become a diligent student of social economy. You must, in your own thoughts, dwell upon these evils, trace them back to their causes, and on to their consequences, especially their consequence to the prodigal's children, and you must furnish yourself for your conversations on these subjects with exactly those facts for the foundation of your principles, and those illustrations for the enforcing of them, which the teacher of economic science waits anxiously to communicate to you. So prepared for your good but arduous work, you will do good. The hearing which your character secures for you, will be turned to account by the knowledge your economic studies will have given you. And I dare promise myself that even whilst thrilled with joy at your first success, you will say, "Now I know what *use the study of social economy is to me;* it makes me a more powerful means of doing good."

5. One other illustration, and I close my lesson. Fix your attention on our most signally successful men of business, and observe how many of them have risen from the ranks of workmen, or are the sons of men who have so risen. You need not be surprised at this. When a saving workman is a man of scrupulous integrity, and adds to his finger-industry that brain-industry which endows man with intelligence and skill, he becomes far too precious a soldier in the army of industry for the organizers of human labour to leave him in the ranks. There is higher work for him to do, and he is allured to do it by promotion and reward. First, overseer or foreman, then general manager, then junior partner,—in each capacity he earns and saves, and wins a name, until at length he finds himself a chief directing the labour and the enterprise of others. If I were to step into your school, and call out the good boys, I might very fairly say, though I cannot exactly

tell which of your boys shall run such a course as the one I have depicted, it is very probable some one amongst you will; and that I may teach *him*, I must teach all. Let me fix upon you, then, as one likely, in your manhood, to find yourself in possession of an income far exceeding that which at present supports your home. What (says the teacher of economic science) will you do with your wealth?

Will you devote it to the good work of abating misery, both in those around you and in those who are to follow you?

B. I should like to do so, I'm sure.

S. I don't doubt you. A boy who earns and saves for himself will, if his parents and his schoolmaster have turned his thoughts towards what is truly honourable, be very likely to feel as you do. But the next question is, whether, having the disposition to devote wealth to noble uses, you will be at the pains of getting the knowledge that will enable you to do what you wish done? But let me not deceive you. You will need the discipline which the study of social economy will supply, and you will need something more. Guided by the truths you have learned from economic science, you will enter upon the wider field of social science, and, as its student, investigate the life amidst which you live.

Be not dismayed at the task. The misery of those around you will seem to promise only that which is repulsive, but the repulsive ness will disappear as you learn to be an efficient means of good.

The court in which cholera rages is a shocking sight; but no one is so little pained by the spectacle as he who can bring together the physician to cope with the disease, the sanitary officer to cleanse and to ventilate the region of it, the means that will furnish food and clothing and medicine, and who can add to all that kind spirit of guidance which, whilst it supplies wisdom to the ignorant, can evoke the good feeling of the sufferers to aid in their own cure.

Do not be dismayed. Amongst the lessons economic science teaches are these: Take that pauper boy, and whilst discharging your duties as a citizen, in the administration of relief, consecrate your abilities, and devote your wealth, so that he shall not be a pauper, and the father of paupers when he becomes a man. Take that criminal boy, and religiously using the influence your education and your wealth have given you, *educate* him, allure him from the paths of sin to the ways of wisdom; let him, as a youth, recruit, not the ranks of crime, but the army of industry, so that his children may have their minds formed at home, not *re*-formed at a penal school. These lessons will not dispirit you. Rather, seeing that the evil exists and must be coped with, they will inspirit you for the work.

And thus, at length, though but roughly answering the first question you put to me, I am prepared to give you two or three lessons that shall help you to understand how this knowledge is to be obtained; but I cannot finish this lesson without expressing the hope, that the concern you evidently have in the knowledge offered, and the promise it holds out of fitting you more skilfully to benefit others, will have incited you to desire it, will have made you regard it as knowledge that will help you worthily to discharge a man's duty in life; help you righteously to deserve your own esteem, and to win, as the good and useful man's reward, the approbation and the love of those amongst whom you are to spend your days whilst you live, and by whom you would desire to be remembered when your work here is finished.

II.—PRODUCTION AND MACHINERY.

Hoping that my former lesson has created in you a desire to master at least the elementary parts of Social Science, let me attempt with you now a lesson on machinery. You will remember the difficulty in which we were left by the dispute, as reported in the newspapers, between the master shoemakers of Staffordshire and their men. The men said, "If you introduce that machine you will throw us out of work." The masters answered, "Yes, the machine will throw you out of work, or some of you at least, but the introduction of the machine cannot be prevented. The trade will leave us if we do not accept the machine."

In this lesson and the next, I shall endeavour to clear up this difficulty. I shall endeavour to show you that machinery *does not "throw men out of work;"* that all it does is *to change the work they are to do;* and that so far from its being an injury to the working classes, it does, whilst it benefits all, specially benefit them. In my next lesson I shall show you that the trouble which, at present, the working classes suffer whenever machinery is extended, is due, not to the machinery, but to a cause of altogether another kind—to a cause which is itself removable, and is, I am happy to say, in course of being removed. In the present lesson, however, I propose to restrict our consideration to what it is machinery does for the people in general, for the working classes in particular, and how those classes would be affected either by a diminution of the machinery we now possess, or by a successful resistance to improvements in it in the future.

If I succeed in what I am attempting, your difficulty will be removed. You will know that machinery is a benefit to mankind at large, as indeed all men seem to feel—the educated by the way in which they defend and welcome it, and the uneducated by the way in which they avail themselves of its powers when once it is established, although they have spent their strength and spoiled their tempers in opposing its introduction. You will also know, that inasmuch as machinery never destroys the means of supporting men at work, but simply changes the work to be done, the journeymen shoemakers are wrong in saying, and the master shoemakers are wrong in admitting, that the new machine will throw people out of work. You will see with the masters that the new machine *must be introduced*, and you will know why. And in the next lesson you will see the means that ought to be taken on behalf of the workmen for preventing that suffering which at present invariably attends the invention of new machinery, and is so commonly but so erroneously imputed to the machinery itself.

With the machinery of which I am about to talk, I hope each boy's reading school-lessons will have made him to some extent acquainted; and in speaking of the greater productiveness of machinery, I shall confine myself very mainly to its greater productiveness of those things which constitute the very necessaries of civilized life.

Machinery in the Production of Food.

Let us begin with food—say the bread eaten at breakfast this morning. It was produced by the help of machinery. For the draining of the land, for the sowing of the seed, for the thrashing and the grinding of the corn, and for the carriage of it from the place of its growth to the place of its consumption, machinery has been at work for us—machinery which a century ago was wholly unknown. And now let us ask what has been the result of this introduction of machinery into agricultural work. We can easily and certainly ascertain the result. The history of each machine is well known, as well as the history of the nation during the period of which we are speaking; and the assertions I am about to make are as indisputable and as undisputed as the leading facts in the history of the House of Brunswick.

Agricultural produce has been greatly increased. Land which at one time could not be cultivated has been made fruitful. Land which was under cultivation has been made more fruitful. The agricultural labourers are not fewer, but bread is more abundant. Nor is it bread only that is more abundant. We not only more frequently crop the same land with corn as good in quality and more abundant in quantity than in the days when farming was done almost without machinery, but we make the same land grow for us more butcher's meat, more tallow, more wool, and more hides. To such an extent has this increase been carried that in those parts of Britain where the use of agricultural machinery has been most extended, the produce of an acre of land in grain is nearly three times as great as in France, where the agricultural machinery of which we are thinking has not yet been introduced, whilst the difference in the quality and quantity of butcher's meat, and of wool, is even greater in favour of Britain.

If the people were so disposed we could easily drop down to the level of French production. The destruction of our comparatively newly-acquired machinery, and with it of the ideas and feelings from which it has sprung, would bring about such a state of things quickly. We then should have less bread and meat for food, less tallow for artificial light and for soap, less wool to turn into cloth, and fewer hides for the making of leather. There would be less of these necessaries of civilized life for us to consume, and we should *all* be injured. But would the injury fall alike on all, or am I not right in saying that although all would in some degree suffer, the suffering would fall with most intensity on the working classes and on the poor? So certain are men generally of this truth, that the abundant harvest is made a cause of religious thanksgiving throughout the land, and the season of scarcity is deemed the time when special efforts are to be made to relieve the poor. We cannot then desire to diminish machinery, for we desire not diminished but increased production. Neither can we rail against machinery as being hurtful to the working man, for we see from what has been said above that it is furnishing the materials in greater abundance for the employment of the miller, the baker, the candle-maker, the soap-boiler, the wool-stapler, the spinner, the weaver, the dyer, the tailor, and the tanner, and through the agencies of these workmen, is increasing the stock from which workmen get what they themselves and their families consume.

But there is another question concerning agricultural machinery; the most intelligent and successful of our farmers are asking for more, under the impression, of course, that it will render their work more productive. The agricultural locomotive, after long trial and many failures, has been turned to good account. It has been taught to do a variety of work, and one of its most remarkable properties is, that it will come up to the barn door or to the rick in the corner of the field, and there, joining itself with the thrashing machine, will, with wonderful rapidity, and at any time that is most convenient to the farmer, enable his labourers to thrash out for him his corn. The farmer thus so efficiently helped is asking whether this same machine could not assist his men still farther; whether it could not assist them to reap and to plough.

Up to the present time these desires have not been satisfied, but the expectation of our most intelligent machinists is that at a period not far distant both objects will be achieved. With what feelings are we to regard these efforts? I answer, we wish them success. We shall be glad to know that the ploughing can be done better and more quickly by some new application of machinery, so that the shortness of the season during which so much of the ploughing and sowing must needs be done, may no longer check the productiveness of the farm. During this year no small portion of the otherwise excellent barley harvest in Norfolk has been seriously damaged, because the ripened crop had, whilst waiting for the hand-reapers, been again and again saturated with rain. We shall be glad to know that the machinist has armed the farmer and his workmen with a machine that will save them in future from the need of waiting, that will as nearly as possible enable them to make the favourable days for reaping all-sufficient for the work to be done; for we see in these improvements a means of increasing yet more the stock from which we are all to draw certain necessaries of life, and the means of giving further employment to workmen.

Machinery in the Production of Clothing.

But to take a much more striking instance of what machinery is doing for us let us turn from food to clothing. The boy who is reading this lesson wears a cotton shirt. From the moment the cotton wool of which that shirt is made touched the shores of Britain, it became, so to speak, the victim of machinery. A machine lifted, from the ship to the wharf, from the wharf to the railway truck, the bale in which it was packed. A machine called a locomotive carried it off to the factory of the purchaser. There it was beaten, carded, spun, wound, woven, bleached, printed, packed, all by machinery; and again the locomotive was waiting to carry it from the mill in which it was manufactured to the port where it was to be shipped, or to the town in which it was to be consumed. What has been said of the shirt might, with but little change, be said of the corduroy trousers, the fustian jacket, the woollen cap, and the silken neck-tie. And all this machinery also is of comparatively recent introduction. As we said of the machinery of the farm, its history is well known, and its results indisputable. Amongst those results are two to which you must give special heed—

1*st*, Never had the poor comfortable and wholesome clothing in such abundance as since machinery has made it for them.

2*d*, This machinery, instead of destroying, has created employment to such an extent, that in the county of Lancashire, it has called together and now employs more people than were to be found in all the kingdom of Scotland when cotton-manufacturing machinery was about to be given to mankind.

True, in its progress it changed the work to be done, and great misery attended the change. The newly-invented power-loom said to the hand-loom weaver, "Leave off throwing that shuttle by hand; see how much better I can do that work. I can make many yards of cloth to your one. Leave off that work, and come and wait on me. I want constant watching, but in a little while you will be able, whilst attending to me to watch two or three other looms also, and to keep us all in order and at work. By means of working *with* us you will be able to clothe twenty times as many people as you do now, and to clothe them better." But the hand-loom weaver answered, "I won't work with you. I'll break you if I can. If the law prove too strong for me, and compel me to refrain from violence, I'll rail against you, and throw my shuttle as in days when you were unknown I was used to throw it. Clothe twenty people, indeed, where I now clothe one! What are these people to me? I must look out for myself. I was taught to work in a certain way, and I won't alter." And he did not alter. The manufacturer would have preferred him to attend on the power-looms, especially whilst they were new, and no one could be said to be skilful at them, but his obstinacy, although it might hamper the master for a time, did not prevent the latter obtaining the assistance he needed. New hands were brought together. *Employment was given to them*, and the people, whose clothing was improved by the new machinery, left the hand-loom weaver, and clothed themselves by the power-loom.

The change the power-loom had wrought in the mode of working would, no doubt, in any case, have considerably inconvenienced, for a time, the man who had been brought up to the hand-loom, but the misery which he *did* insure was not the fault of the new machine—it was self-inflicted. It grew out of his obstinate opposition to an improvement in man's power of production. Happily the opposition was futile. The machinery was improved and increased. It began to clothe other nations. They in return sent us the products of their industry, and began, in not a few instances, to seek from us machinery to help them in their work. And thus ever increasing in its productive power, ever giving more and more employment to the work-people at home, has the machinery of the cotton and woollen manufacturers become the means by which chiefly we obtain for ourselves the cotton, wool, silk, tea, coffee, sugar, and spices which we cannot produce in this country, and the wool, timber, hides, tallow, bones, and horn which, superabounding in the thinly-peopled nations of the world, are required amongst us in far greater quantities than our densely-inhabited land will produce.

Suppose now all this machinery destroyed. At least a million of working people would be reduced to a state of suffering as great as attends a famine, and suffering, in a degree more or less intense, would be inflicted on us all. Destroying our power of production, we should destroy the means by which at present we carry on interchange. Having less to give in exchange, we should get less in exchange. There would be less in quantity of tea, coffee, sugar, corn, clothing, leather, &c.; and inasmuch as the wealthy would give up their luxuries in order to obtain a sufficiency of these necessaries of life, the diminution of the stock would fall with intensest severity on the working classes, and on the very poor.

The length to which we have gone in considering the productiveness of machinery in food and clothing, will oblige us to pass over much more rapidly the other instances we are about to bring before you.

You will, however, be able for yourselves to extend what is given; for the lesson taught us by each instance, however differing in details, will in the main be the same; and that lesson is,

Machinery creates, not destroys employment; benefits, not damages mankind.

Machinery in Mining for Fuel and Metals.

Let us now turn to another branch of our subject,—machinery helping the miner to produce for us those necessaries of civilized life, salt, fuel, and the metals. From your school-lessons you will already have learned something about mines and minerals. You will know, that although in newly-settled countries the surface of the earth yields some minerals in considerable quantities (as for instance, Australia, gold and copper ore; some parts of South America, nitrate of soda; and some of our American possessions, small quantities of coal), yet, to obtain minerals in any quantity in an old country like Britain, we have recourse to that industrial arrangement called a mine. Your school reading will probably also have taught you that we mine with such success as to export vast quantities of mineral products, obtaining of course, in exchange for them, other products of industry which we feel we need. These mining operations give employment to vast numbers of working men, and their employment would cease immediately, *but for machinery.*

At present, we produce salt for the seasoning of our food, for the preservation of both meat and vegetables, for the potter to use as a glaze, the farmer, as a manure; and thus the products of British industry which they require are produced by the men whom the machinery has helped to produce the salt. But, besides all we consume at home, we export on an average, 12,000,000 bushels a year. This export means, that by exercising our industry as machinery enables us to do on certain saline formations at home, we produce for ourselves elsewhere tea, coffee, sugar, drugs, dyes, timber, hides, &c., which we could not produce here. Stop the machinery, and you would lessen—nay, you would almost totally destroy—the production of salt in England, and you would diminish the quantity of it which mankind is now so glad to use, and throw out of employment the workmen engaged in the production. And, as before, the working men and the very poor, are those who would suffer most from the diminished production.

But far surpassing in magnitude our production of salt, is our production of fuel. In thinly-peopled countries, timber yields all the fuel required, but in Britain, the density of our population, and the extent of our industrial operations, have obliged us to seek another source of supply. Wanting the land to grow us corn and meat, we have cleared our forests, except a few that are reserved for public or private enjoyment. Even for building purposes, we import timber. For fuel, we resort to the mineral, coal. There runs through England, from the forest of Dean to the river Tyne, a series of rocks, called by geologists, the carboniferous strata. What we may call parallel ranges of these strata, run through the south of both Wales and Scotland, and a busy scene indeed is the surface of Britain over this geological formation. It is too, a vast, wide belt of machinery. Steam-engines dot the surface on every side. That eminently mechanical contrivance, the locomotive on the rail—itself one of the offspring of colliery intelligence—here finds its greatest development. Does any babbler tell you that machinery throws men out of work? Tell him, that to destroy this machinery, would drown out every coal mine in Britain in a week, would throw the whole of the working colliers out of work, would stop the locomotive, the steamship, and the cotton and woollen mills of Lancashire and Yorkshire, and would leave the working classes and the very poor —say of such cities as London and Glasgow—during the coming winter in such a state for fuel as he had better describe. On the other hand, imagine, what is by no means unlikely, that all this machinery were hereafter so extended and improved, that a ton and a quarter of coals should be produced in the place of every ton, would such increased production be anything but a benefit, and may he not rest sure, that as the wealthy already do not spare for fuel, a large part of the increase would go to warm the homes of the working classes and of the poor?

For yet another purpose is this fuel-producing machinery a boon to us—for the production of metals. It helps us to drain the mine, to lift the flux, and to lift, to roast, and to smelt the ore. It enables the workmen of South Wales to get employment in smelting the copper ore both of England and of South Australia, and working by the side of other machinery, it gives employment to the vast crowds of workmen who are engaged in Britain in the production of iron. We make iron, not only for ourselves, but for half the world besides. Why? Iron ore is found, and in comparative abundance, in some parts of nearly every country on the globe, and very commonly both fuel and flux are not inconveniently distant. Yet we do the work, and were some foreign nations more enlightened we should do still more work for them, simply because we possess in our machinery and our mechanical arrangements greater power of productiveness. And having obtained the metal, we are armed with other kinds of machinery by which it is fashioned to the purposes we need. The cast-iron we do not require for the foundry is passed on to the puddler. As soon as he has converted it into wrought-iron by the help of the steam-hammer, the immense steam-rollers under his control will turn it into a rail for the railroad, or a rod or bar or a bolt for the smith, or into thin plates to be stamped into trays, or into still thinner sheets, for the use of the tinman. And at every fresh process of manufacture, fresh machinery helps in the work. In the metals, the work done for us by machinery is really wonderful.

The school-boy wears a machine-made tip on the heel of his boot, a machine-made tag at the end of his lace; he fastens his coat and his trousers with machine-made buttons, and now-a-days trundles a machine-made hoop. He carries in his pocket a knife which the tilt-hammer has helped to forge. At his father's table, he sees on a machine-made tray, the machine-made pot which holds the coffee or the tea, and with a machine-made spoon he helps himself to sugar which is before him, and that in greater quantity, because the machine-helped workers in metals in Britain have found employment in making machinery, by which the sugar-grower of the tropics has expressed more thoroughly the juice from the cane, and crystallized from it a greater quantity of sugar.

Did the limits of the lesson allow, it were an easy thing to increase these instances of machinery giving employment to the workmen in the metal trades. We might, with great care and interest, go over the manufacture of lead, the process by which increased knowledge has enabled us to save the silver from the argentiferous lead ore, and the comparatively newly-acquired knowledge and machinery which has brought zinc into common use; but it is desirable that you should dwell for a short time on some other instances of the work done for man by machinery, and trace out the special benefit it confers on the working classes and the poor.

Machinery in Providing Water.

Think for a moment how important a constant supply of water is to man, for drinking, cooking, washing, and very many manufacturing processes. In thinly inhabited countries, and in the rural districts of Britain, each household contrives by its own labour to supply itself with water as well as it can. Frequently the supply is unwholesome and scanty. During the last autumn our newspapers were constantly recording instances in which the drying up of the brooks and the failing of the springs inflicted, especially upon the cattle-farmer, severe loss. During the same season, London and Manchester were as abundantly supplied as ever: *they* were supplied by machinery. The case of Manchester is a very remarkable one. A few years since, scarcely any considerable town in England was worse off for water; now there is perhaps no city in Britain in which, in respect both of quality and quantity, the supply is better. And this beneficial change has been effected by the adoption of those mechanical expedients with which we were previously acquainted, and the introduction of some exceedingly ingenious and novel arrangements. The water, gathered in great abundance, and in a high state of purity, is made, one might almost say, to carry itself into every house of every street, lane, and court. A similar spirit of intelligence has given to Glasgow a like unlimited supply of even greater purity.

But alongside of the supply of water, another great work is being attempted, and machinery plays a most conspicuous part in it. I mean the drainage of great towns. We are, I am sorry to say, but ill-informed yet as a people on sanitary matters, but the drainage question has been placed by public consent in the hands of our most able engineers and machinists, for from them only does it seem possible to obtain the required help. We know how London has suffered from plague, Newcastle from cholera, and the poorer districts of our great cities from frequent visitations of typhus. From such scenes the wealthy man removes himself and his family, but the workman and the poor must live close to their employment. The washing of their clothing must be done at home. Forbid the extension of machinery to supply the cistern, the bath, and the wash-house, and you doom the poor to uncleanliness in person and in clothing; forbid, at the same time, machinery to do the drainage, and you make our courts and alleys fever-beds, you doom the elder poor to feeble health and fewer years of life, you encourage the habits of intemperance which thrive so much in scenes of filth and chronic sickness, and you increase, at a rapid rate, the mortality of the very young.

Machinery in the School-room.

One other instance, one specially for the school-boy, and I have done. The day is fast approaching when every child of honest parents in Britain will have placed within easy reach of him the elements at least of a good education. Unhappily we have heretofore been neglectful of this duty. The Registrar-General tells us that of the people who married last year four-fifths were unable to sign their names. If you have derived from your school the good your parents hope for, you will be glad to know that the present age is making great and anxious efforts to wipe away this stain upon our national character. You will see with joy the new and improved school-house with its better furniture, its plentiful supply of books and of writing materials, its diagrams and apparatus, and as the old folks tell you how utterly they were without such advantages in the days of their childhood, you may feel inclined to inquire how it is such advantages have befallen you. Doubtless many good things have been working together for your good, and conspicuous, indeed, amongst them is that love of the young which knowledge begets in the mind of the really educated. But the spirit of philanthropy has found a mighty helper in the increased productiveness of all industry in the present day. We do not surpass in love for childhood, Henry Pestalozzi, nor in devotion to our work, Bell and Lancaster, but we have means for carrying on our work such as they never hoped to possess.

The pupils of our first National and Lancasterian schools met in buildings little better than barns, and stood most usually on a paved or earthen floor. They were almost without books. They practised the making of letters (I will not call it writing) in trays of sand. You have a wooden floor, the sawing and the planing mills have helped you to it. You read from books and write on paper, because the printing and paper machines are pouring out on us these materials in ever-increasing quantities, and because other machinery is turning prepared metal into myriads of steel pens. You see in the cabinets of your teachers better chemical and natural philosophy apparatus than Davy or Priestley possessed until they had become renowned and wealthy men, and you have these things for your use because the instrument-maker, in common with all intelligent men, has availed himself of those mechanical helps that render industry more productive. Could we destroy all those mechanical helps, how sad would be the consequences! With the stoppage of the printing-machine we should cut off our supply of school-books. With the stoppage of the paper-making and pen-making machines we should expel from our schools the art of writing. Thousands of boys who now have education placed within their reach would be condemned to enter life unable to write a letter or to enjoy the reading of a newspaper. But we do not intend to stop this machinery. On the contrary, we are prepared to welcome its increase, for we know that machinery is a benefit to mankind.

Thus we have found machinery producing for us more food and more clothing, increasing the comfort of the houses we live in, improving the tools with which we are to work, supplying us almost at no cost with water for all our wants, and when, having soiled that water with the double quantity of soap which the improvements of the last half century have given to each of us, find it endeavouring to do its best in the work of carrying it away.

With these things in our mind, how can we for a moment believe that machinery diminishes employment? or that it damages working men? The ignorance must be very dense, and the thoughtlessness very habitual, that permits men to make such assertions.

But it may be urged, machinery at the time of its introduction brings suffering to workmen. The same ignorance and thoughtlessness are shown here. When machinery is improved and extended, it does of course change the work to be done, while it increases the quantity produced for all. It changes the work. It does not destroy employment. It leaves untouched the fund called wages, out of which workmen and their families are to live, and it hastens to increase that fund. Meanwhile, what is the lot of those with whose work it has interfered? That depends, I answer, on the man, not on the machine. The machine is the cause of the work being changed, the man himself is the cause of the good he acquires from the change, or the misery he entails on himself.

Never yet was machinery invented but it gave new employment to some, and better wages to more. Never, I am sorry to say, has our stock of necessaries and comforts been increased by machinery, but misery, self-inflicted, has been suffered by others. How for the future we may get the good without the evil you will better understand after the lesson on wages. At present I shall leave you, hoping that I have excited in you a spirit of inquiry, and a desire for truth. If I have, you will for yourselves find out that, crowded as this lesson is with illustrations, not one of those illustrations has been exhausted. You will be able now to institute and to follow out for yourself such inquiries as these: Which is the happier nation, and of which would I rather be a citizen; of the one where machinery is abundant and ever increasing, or ot the one where the dulness of the people is slow to invent, and their ignorance prompt to reject improvement? Is it better to be an Englishman or a Spaniard? a Yankee or a Turk? If I emigrate, to which colony should I prefer to go—to the one that will welcome the new plough, the sawing-mill, and the railroad, or to the one where all the work must be done in the way and with the tools such as England used in the days of the Plantagenets? Habituating yourself to such exercises, you will do more than merely acquire information. You will greatly improve your mental powers in general, and your power of reasoning in particular, and you will be fitting yourself, as far as regards the investigation of social phenomena, for becoming a useful man. As you go on, you will of course get knowledge, but you will also get wisdom.

III.—ON DIVISION OF LABOUR AND ON VALUE.

In all countries where civilisation has made any progress, the productiveness of industry is increased, not only by the adoption of improved machinery and tools, but by an arrangement called Division of Labour. Each man devotes himself to the production of some one thing, or set of things. He becomes extremely skilful at his work, he knows exactly how to select his materials and his tools, and he gathers round him a stock of tools which he contrives always to keep in use.

Division of labour is attended immediately with the following results. The quantity of things produced is greatly increased, and so also is their quality, and this increase in both quantity and quality is accompanied by as remarkable an economy of the tools and buildings necessary for the work. We need not stop to find illustrations of the division of labour. Every instance which was used in the lesson on machinery will serve to illustrate this arrangement, and to show how great are its benefits to mankind.

What we need to illustrate now is that *division of labour* NECESSITATES *interchange, and fixes the attention of men not only upon the* USE, *but upon the* VALUE *of their productions.*

A man devotes his ability and his property to the making of some one thing—say bricks. He becomes exceedingly skilful in his work. He is an excellent judge of the land that will furnish him at once with a site for his work, and the material he is to work with. He chooses the handiest tools, the most labour-saving machines, and the ablest workmen, and he learns to understand better than we do ourselves the form, fashion, and quality of the things we require. Compared with anything that a person unused to brick-making could do, he is, both in the quantity and quality of his work, a prodigiously productive man. And he is surrounded by neighbours who, differing from him in the branches of industry to which they devote themselves, are exactly like him in their wonderful productiveness.

Whilst work is going on in this way amongst us, we know that a very different state of things exists where man is not civilized, and also where man has removed himself far off from the neighbourhood of his fellows.

We may as well pass by the savage and the barbarian, and fix our attention upon what is being done by our friends and relatives in the interior of Australia, or in the far west of the United States. Each settler makes his own bread, grows his own corn and vegetables, rears, milks, and slaughters his own cattle, makes the candles and soap which he uses, fells and gathers the fuel which he burns, and dwells in the hut which he has himself built. The quality of what he produces is in most cases poor enough, and the quantity very small. There is a patch of brick and stone work where he burns his fuel, the rest of his hut is built of logs, but neither the brick-work nor the wood-work can be compared with those in our dwellings. So well does the settler himself know this, that he is longing for the day when the increased population of his district will enable him to increase the productiveness of his industry, by adopting to a small extent at least, Division of Labour. Meanwhile, it is easy enough to understand what he is about. As well as he can, he is producing the very things which he and his household intend to consume. The brickmaker at home, is on the other hand, producing what he intends other people to consume. Like the colonist, he intends of course, that the work he is doing shall put him in possession of the things he and his family wish to consume, but he can obtain those things only by interchange, *i.e.*, by giving his bricks in exchange for them. The exchange is managed by the aid of another contrivance, for increasing the productiveness of industry. The bricks are given for money, and the money for those other products of labour which the brickmaker wishes to consume. How greatly money facilitates interchange, we need not stay in this lesson to show. Our business now, is to fix our attention on the fact, that, whether more easily, by employing money as the medium, or more clumsily, by bartering, interchange is necessitated by division of labour.

But this interchange brings in a new and very important thought—Value. "What shall I get in exchange for what I am producing?" must be ever present with the man who confines his attention to some one department of labour. For the phrase, "What shall I get in exchange for my production," the economist substitutes, "What is its *value?*" and if he be a logical reasoner, he takes care, whilst handling economical subjects, to use the term "value" with this meaning only. He carefully discriminates between "use" and "value." With him, the use of iron, and the value of it, are questions no more to be confounded, than the colour of the metal and its weight. Unfortunately, however, this scrupulous attention to the *using of a term with one meaning only* is rare. Men of considerable learning, even when engaged in expounding social questions, use terms with a looseness of meaning that they would regard with horror in a mathematical discussion, and many are the fallacies in which, in consequence, they involve both themselves and their hearers. From the fallacies depending on the equivocal use of the term "value," you may save yourself by substituting for the word, whenever it occurs in an economical discussion, the synonymous phrase, "what it" (the product in question) "will fetch in exchange." The right use of the term will enable the argument to bear this substitution, but the substitution will in a moment betray equivocation, and will thereby warn you against the impending fallacy.

But to return to the producer: he will be unwilling to produce that which is of small value, and anxious to produce that which is of high value—a state of mind, which will set him producing those things which the people who are to consume them most desire, and that will influence him very seriously in the payment of wages. And now, we may proceed to the consideration of wages.

On Wages, and the Laws which Regulate them.

We have before us two sets of people—the masters and the workmen, or, as they are usually called in economical treatises, the capitalists and the labourers. The capitalist is so named, from his possession of capital, that is, *of the products of labour accumulated and stored in the past, and devoted in the present to consumption in the work of producing for the future.* The capitalist hopes by the way in which he is wearing out and consuming his capital now, to reproduce it in the future with increase, and to this increase, the name Profit is given. The capitalist, whilst he is at work for this future good, profit, supports himself out of his capital, and out of it also he supports those whom he engages to assist him in his work, *i.e.*, out of his capital, he pays his labourers their wages. At this stage of the lesson it is important for you to notice,—

1. That capital is something which has been produced in the past and cannot suddenly be increased.

2. That wages are the means by which labourers subsist in the present, and that they must be limited in quantity by the largeness or smallness of the previously produced and stored products of labour (the capital) out of which they are to be paid.

3. That profit is something to be obtained in the future, not something which already exists.

As the mastering of these three fundamental points will make the whole subject easy, I shall be at some pains to illustrate them, in order that you may thoroughly know their truth, and therefore understand how the laws which regulate wages—of which I am to speak presently—depend upon and grow out of them.

Let us fix upon some one capitalist, say a ship-builder, and let us suppose, when we begin to observe his operations, he is already in possession of the site on which, and of the timber and metal and tools and machinery with which to build a ship. And further, we will suppose that when the ship is built, he intends to sell her, hoping of course to get for her what will replace all he has consumed in her construction, and leave him something besides—his profit. Clearly, the timber which has been felled, lopped, and carried to the ship, the copper and the iron which have been produced from their ores, the tools and machinery which have been produced from previously prepared wood and metal, are the results of labour which has been done in time *past*. These things constitute a part of the ship-builder's capital, but besides these, he needs other capital; he needs the means of keeping his labourers whilst at work; he needs the means of paying wages.

We may ask ourselves here, why does the capitalist work for profit? Why do the workmen work for wages? It is very plain that the capitalist might, if he chose, work for wages, by engaging himself in any work for which he is competent, to some other capitalist, and whilst so working, might yet derive benefit from his capital, by lending it at interest to some one else. We can have no doubt then, that in choosing to work for a profit, he feels sure that he secures for himself more than he could obtain from wages and interest put together; and for the purposes of our lesson, we may suppose him right in his decision, and that his workmen know him to be right. Why then do they not also work for profit instead of wages? In free and enlightened countries the laws do not prevent them, and for the sake of argument, we will grant that they have the necessary skill. What is it then that stops them? *They do not possess the necessary capital.* They are not only without the premises, the building materials, and the machinery, but they cannot even wait for the profit. They (and those depending on them) must be fed, clothed, &c., whilst the profit is being earned. They need out of the products of past labour, which are not their own, the means of supporting themselves *now.* The products of past labour, the capitalist either has in hand, or the other portion of his capital of which we spoke above, will exchange for them. Hence the bargain for wages; and hence, as we see, wages must be regarded as a payment made in the present for the present sustentation of the workmen out of the stored products of labour done in the past, in order that profit may be earned in the future. It need occasion us no difficulty that wages are usually paid in money. To make the payment thus, is an obvious convenience to both parties, but we must observe that the money which is received by the workmen, is, as it were, simply an order which will be attended to by the baker, the butcher, the coal dealer, the landlord of the house in which he lives—in short, by all capitalists to whom he may present it. Not the money, but the commodities he procures with the money, are his *real wages*, as much so, as if the master ship-builder had in his yard a bread store, a meat store, a fuel store, &c., and sent the workman with a ticket or token to each of the store-keepers for portions of the capital under their care. We shall not then trouble ourselves much at present with the money wages, but fix our attention on the real wages—on those portions of the stored-up products of past labour, which the workman, by his labour for the capitalist, has now made his own, and is depending upon for his and his family's present support.

There is, however, one peculiarity of money wages that may as well be noticed here: they may remain as they were, and yet the real wages be seriously altered. Every boy knows that a sum of money will at one time buy more than at another, that, for instance, sometimes 1s. will buy two loaves, and sometimes but one ; and his father will tell him that money wages do not rise when prices do—that much the same quantity of work will be done for a sovereign when bread is at a shilling a loaf, and other food dear in proportion, as was done when bread and other necessaries were at much lower prices, and perhaps he will add, that as a rule, work is rather more difficult to be obtained when food is very dear. If now we drop the money out of sight, and revert again to the real wages, the case stands thus : the capitalist, when he now sends his workmen to the various store-keepers, writes an order for a half loaf instead of a whole one, and yet is rather less willing to give employment than when he was giving the whole loaf.

How shall we account for this alteration in the rate of wages ? or, to put this inquiry into a better form : *What regulates the rate of wages ? I answer, The quantity of capital available for the payment of real wages, divided by the number of labourers who must subsist out of it.* We must carefully investigate this answer. That we may do so, it will be necessary that I expose some fallacies with regard to profit with which workmen ordinarily delude themselves. They in their trades-union speeches are continually asserting, "We, the workmen it is, who earn for capitalists their profit." "Our wages are paid out of profit." "Large profit for the capitalist means small wages for the workman, and increased wages for the workman means diminished profit for the capitalist."

Whilst workmen are talking thus, we see around us capitalists of two essentially different kinds—those who make profit, and those who lose their own capital, and (too frequently) some portion of their neighbour's. Does any one affect to say that the ruin of the one man is due to his workmen ? If not, how does it happen that when profit is earned they are to step forth and claim the credit ? Any one who will investigate the subject will see, that besides the well-doing of the manual labour, it is necessary, in order to make a profit, that there should be a thoroughly enlightened organization of the means of production. Organization and administration are the talents required in the capitalist. Where they exist in a high degree, large profits are made ; where they are wanting, loss will assuredly occur. How foolish then as well as false is this boasting on the part of the workmen ! Does the sailor before the mast claim that he navigates the ship? Yet such a sailor on board one of our large profit-earning steam-vessels, would be quite as wise in forgetting the important work done by his captain and officers, as in forgetting the equally important work of management done for captain, officers, and men, by the capitalists who own the ship.

The fallacy that wages are paid out of profit is another extraordinary blunder. Wages are paid whilst the work is going on, and, in the main, are being consumed as fast as they are paid. Profit is something to be attained in the future. It may be missed altogether, but the wages will have been paid. Workmen know well enough that wages are paid for doing work which may, and sometimes does, end in a loss. In such a case, what are the wages paid out of? Not the profit; not the loss: but out of that store of the products of past labour which we call capital. As at any moment of time on which we choose to fix, this store is a definite quantity, we see how the rate of wages will be great or small, in proportion as it is great or small compared with the numbers whom it is to support, and that in a community where there is but half enough food for the workmen, no profit which is hereafter to be made will enable the capitalist to distribute a sufficiency of food.

But here is an even more striking exposure of this folly. Profit is not great enough nor nearly great enough to pay the wages that are being distributed. An enormous portion of the work we are all doing is the work of reproduction. If happily we do our work well, we shall find that we have reproduced all that has been consumed, including wages, and that something remains over. This something, a small portion indeed compared with what has to be replaced, is profit. The hope of earning this profit induced the capitalist, in the first instance, to risk his capital in the payment of wages. The profit, after it has been earned and saved, may be turned into fresh capital, and so increase the fund out of which wages are to be paid in the future. But present wages cannot be paid except out of capital, and the profit hereafter to be made can neither raise nor lower them.

I shall illustrate what I have said above, and at the same time expose the fallacy, that wages and profit are antagonistic, by some instances from life. You have all heard of the attempt to connect England and America by telegraph. An immense proportion of the expenditure on the Atlantic cable was for wages, paid at the rates current for such work. The company who found the capital submerged it, in the hope of making a profit. They have, it is to be feared, made a total loss. Surely you are not weak enough to believe that they paid the wages out of profit. Again, the Great Eastern steam-ship affords us another case in point. We know how great has been her cost, and we also know, that up to the present time she has earned nothing. Many of those who originally furnished the capital for her construction—capital, the great bulk of which has been expended in wages—have already sustained serious loss, and her future is still exceedingly uncertain. We hope the best; but we know that undertakings of an altogether novel character have very frequently indeed brought serious loss on their projectors, even when they have been the precursors of general benefit to mankind. The wages, however, for the construction of the ship *have been paid*—not always at the same rate, for during the years of her building, the rate of wages for shipwright's work has gone through extreme fluctuations, and the master ship-builder has been obliged to submit to the rise, and the workman ship-builder to the fall. But subject to these fluctuations, which neither the master, the workmen, nor the chance of the ship's hereafter making a profit or a loss could in any way control, the wages *have been* paid, and except any savings by the workmen, that quantity of capital *has been* consumed. The profit, if indeed any should at length be made, *has yet to be earned.* Other instances showing how the payment and the consumption of wages precede the earning of a profit, would be furnished in the history of every railway and dock, the cultivation of every farm, the sinking and working of every mine, and, indeed, of every considerable work that is now going on. Strange, indeed, it is, that men so deeply interested as are working men in understanding the laws which regulate wages, should shut their eyes to facts lying thus open to observation on every hand, and equally strange is it, that they have deluded themselves into believing in an antagonism between wages and profit; for here also they are contradicted by the facts, with which every day's newspaper is making them acquainted. Whilst they are talking of the large profits of the capitalist lowering wages, and an increase of wages lowering profit, such facts as we have referred to are known to everybody.

Further, in our Australian colonies the rate of profit is higher than with us ; so also is the rate of wages. In Ireland, before the famine, when the rate of profit earned by the scant capital engaged in agriculture was small, the rate of wages was miserable. In the same country we have seen, within the last few years, a rapid increase in the productiveness of capital, attended by a considerable rise in wages. In Lincolnshire agricultural wages are comparatively high ; in Dorsetshire they are lower than perhaps in any other part of England ; yet we know, that if the farmers of the two counties differ in their rates of profit, it is to the enterprising and machinery-employing county of Lincoln we must look for the higher rate. We are thus taught that large profits may coexist with high wages, and small profits with low wages, and that profits and wages may both increase together, as if to warn us from assuming between wages and profit a connexion which does not exist.

Finally, the capitalist who by a long and costly education has been prepared for successfully conducting the business of a machinist, earns a rate of profit, which, compared with that in other businesses requiring equal skill and risk, cannot be called large ; yet he pays his workmen a high rate of wages. The capitalist slop-seller, whose education for his business has been picked up almost wholly whilst he has himself been earning wages, makes a rate of profit which, compared with that in other businesses, cannot be considered small ; yet he pays his work-people wages which scarcely suffice to keep them from starvation. So little connexion is there between profit and the current rate of wages. As was said above, the hope of profit incites the capitalist to pay wages : profit, when it has been earned, may, if he saved, be added to capital, and so increase the fund out of which wages are to be paid in the future ; but the rate of wages now—the power of subsisting in the present —depends upon the stock that has been saved out of the products of labour in the past, divided by the number who must subsist out of that stock. So far, however, from profit being antagonistic to the workman, he should desire to see it increase. Whenever capital is small, compared with those who are to subsist out of it, wages *must* be small, for, rather than be out of work, that is, rather than be wholly without the means of subsistence, the workman will accept small wages, that is, he will put up with less than the desirable quantity of the necessaries and comforts of life. But he will desire to alter this state of things, and there is but one way in which it can be done, that is, by increasing the capital—the means of subsistence—faster than the numbers to be supported out of it.

There are two parties who can assist in this good work. The capitalist, by saving from his profit; the workman, by saving from his wages. When wages are so low as to furnish but an inadequate supply, the profit is the chief hope of raising wages. And yet workmen rail against capital and profit whenever they see them increasing!

Distribution of Wages.—Up to this point, I have spoken of wages in the mass—of the *whole* wages which are being paid out of the *whole* capital by which they are furnished, and I have shown you the law by which wages on the average are ruled, viz., the quantity of capital or means of subsistence divided by the number of those to be subsisted.

We may turn now to the distribution of this wages fund—to individual wages. Notoriously, the wages of individuals differ. In different trades the rate of wages is different, and even in the same trade, different workmen earn widely different wages. We have now to explain these social facts. Let us as before fix our attention by selecting instances. The skilful workman employed to-day in the workshop of the machinist, in making a machine which is to assist in producing sugar for us in Brazil, will earn twice as much, at least, as the skilful ploughman who is preparing the land in Middlesex to grow us grain for next year's food. Why is this? Because the numbers subsisting on the capital devoted to machinery are far fewer in proportion to that capital than are the numbers subsisting on the capital devoted to agriculture, in proportion to that capital. This conclusion, you will see, is in perfect harmony with the laws before expounded. At first sight, it may appear strange that workmen should separate themselves thus unequally as regards the batches of capital which are to sustain them. A little reflection will, however, explain to us how this is brought about.

Where labour is free, as (with the exception of some little interference on the part of workmen themselves) it is amongst us, there are two things which principally determine workmen in the choice of their work. One is the kind of work to be done, and the second, the man's ability for undertaking the highly paid work.

Under the first head, we notice the desirableness or undesirableness of the occupation, each man, of course, having his own notion of what he would desire. Some work is very hard, and requires great muscular strength and power of endurance. Some is very dangerous : some very unwholesome and disgusting. Less, however, is to be attributed to the characteristics of the work than we should beforehand expect. In practice, no peculiar difficulty is found in procuring work-people at low wages to do the hard work of the ballast-heaver and the navvy, and the dangerous work of making up cartridges, of filling percussion caps, or of going to sea, or to encountering the health-destroying atmosphere of the grinding-shed of the cutler, or the covered sewer of the great city. Very probably, as education renders workmen more capable of guiding themselves, we shall see wages rise in these and similar occupations, but at present it is notorious, that in some of the hardest, most dangerous, and most unwholesome occupations, wages are low.

The ability of workmen to do the more highly paid work is then, after all, the great cause of the unequal separation. A man's ability, depending in some measure, of course, on his natural gifts, is, as regards work, very mainly a question of expense in his industrial education. The farm labourer's son is earning wages whilst he "keeps birds," attends on the cattle, and is ready to wait on, or drive for the ploughman. He learns gradually to handle the plough, and bit by bit, picks up the knowledge necessary for making a straight furrow. The boy who enters the workshop of the machinist does so generally as an apprentice. At first he earns no wages, or almost none. Perhaps his father has had to pay a premium as inducement to the capitalist to take him at all. These circumstances thin the numbers who else would gladly learn the highly-paid business. The ploughman would be glad indeed to see his son on the road to receiving the high wages of a skilled artisan, but he needs the small wages the boy in his childhood can earn on the farm, and he sets him to work there. The boy is one of numbers who are receiving almost no special education. Meanwhile the son of wealthier parents has been introduced to the workshop. He gets the chance of handling tools; he learns to handle them without damaging them. The workmen instruct him in their use. He learns to understand, perhaps to make working drawings. He becomes, as a man, a skilled workman, and finds himself one of a class whose numbers have been limited by the expensiveness of a special education, and his wages are high.

But we have now to consider and to explain the fact, that even in the *same* trade workmen's wages differ. The fact is observable enough, but is, after all, too little observed, especially by young workmen, whose thoughts and conduct now are moulding for them their future. Heretofore we have, in our comparisons, spoken of a *rate* of wages, leaving the reader to choose as his measure, either "work by the day," or "work by the piece." In some trades work is paid chiefly by the one measure, and in some, chiefly by the other. The bricklayer, for instance, works most commonly by the day, the cooper by the piece. In other trades, again, a mixture of the two measures is found, but in all trades, as must be plain to the most superficial observer, the thought in the mind of the capitalist is the value of the work done for the wages which he has to pay.

If we agree for the moment to use time as the measure of the wages' rate, we may easily see for ourselves, that in the same trade even, different men earn different wages. It is notorious that the foreman is more highly paid than the men whose work he oversees and directs.

In the building trade, where work is being done at a distance from the workshop, some one of the men is made foreman of the job, and is rewarded for the extra responsibility which he undertakes, with an increase (perhaps temporary only) of his daily wages. And particularly useful men are sometimes retained, especially by large capitalists, at a slightly higher rate of daily pay. But the right way of estimating his wages requires that a workman should consider not only the daily rate at which he is paid when in work, but the *continuity of the work*. A workman's wages are the means by which he supports himself and his family both when he is in and when he is out of work. The mechanic, whose daily rate of wages when he is at work is 5s., if he be one-third of his time idle, really earns but 3s. 4d. per day. The unskilled workman who waits upon him, at the wages of 3s. 4d. per day, is, if he be continuously employed, in receipt of as much wages as he, and since the tools of unskilled workmen are found for them, he may really be better off. We must then bear in mind this method of estimating wages, and especially fix in our minds that this is *the method* by which the workman must estimate his own earnings. If we do this we shall see at once that workmen's wages do differ indeed, and we shall be prepared to ask why? Our question will take this shape; how is it that, even in the same trade, some men obtain wages not merely at a slightly higher rate per day than their fellows, but that their gross earnings during the year are so much larger? *What is the* law by which (average wages having been settled as we have seen before) *individual wages are distributed?*

Individual wages (where labour is free) are distributed according to the productive powers of the recipients. And even when workmen interfere with the freedom of labour, the tendency towards this law is so strong, that, although average wages may be reduced by the interference, the distribution amongst individuals is quickly brought into accordance with their powers of production.

The argument in proof is short, simple, and convincing. The hope of profit induces the capitalist to pay wages. His hope of profit depends on the value of what his workmen, helped by his machinery, and guided by his intelligence, can produce. The more productive a man is, then, precisely the more the capitalist desires to have him. To allure him he will give him the highest rate of wages current. To retain him he will in seasons when work is slack dismiss the less productive hands, and turn the work over to him. An investigation of the facts of life will corroborate the conclusion to which our argument has now brought us, and will enable me to fix your attention on the combination of qualities in the workman which make him the productive man. We shall, of course, agree that he must be a skilful workman. About that there cannot be two opinions. But workmen are too apt to think finger skill in their work the only qualification they need possess. It will be useful for you to notice that the capitalist, in giving continuous employment at the daily rate of wages current in the trade, possesses and exercises a power of choice even amongst men who in handicraft skill are equal. He prefers the sober to the drunken; the honest to the dishonest; the truthful to the lying; the man conscientious in discharge of a trust to the eye-servant; the punctual to the unpunctual; the civil and companionable to the insolent and quarrelsome. We, no doubt, are glad that he does so exercise his choice. We also respect the men who are preferred, and we notice that they are the best hands for the doing of our work. Further, we see in this choice a warning to bad workmen to alter their ways, and a lesson to young and to intending workmen on the effect of Character in the distribution of wages.

To those of advanced age and settled habits the warning, in too many instances, comes, alas! in vain. In age habits cannot be cast off. The old drunkard will be a drunkard still; the grey-haired man, whose youth was spent in ignorance and in an assiduous devotion to prodigality and vice, must remain boorish, wasteful, and destitute. But very different indeed is the case of the schoolboy. He is yet unstained with vice, his habits are yet to be formed, and hence the responsibility which the schoolmaster feels to send him forth into the field of labour prepared to escape the perils in which his elders have been wrecked.

But a lesson on wages cannot be complete without some allusion to "Strikes." Space will permit me to say very little on this subject, important as it is; but I may perhaps usefully adopt here a plan resorted to in our treatises on Geometry. Appended to the propositions which are proved, we have others to be proved. The pupil exercises his ingenuity in seeing how the new truth may be made to grow out of the old, and, needing it, gets assistance from his teacher. So be it here. Each assertion I make shall be proveable from the lesson I have given, or I will add to it such suggestions as will make the acquisition of the new matter easy.

(1.) A strike for the raising of wages is always wrong; it is a suicidal act on the part of the workmen, because a strike always diminishes the means of paying wages; it never can increase them.

(2.) When a strike ends as workmen think successfully for their class, they are mistaken: all a strike can do is to alter the distribution of the wages—*i.e.*, to take from one class of workmen, and to give to another; in other words, a strike is said to be against the masters, but is, in fact, against other workmen: *e.g.*, The brass-founders limit the number of lads to be employed by the masters, and so, as they believe, limit the candidates for wages in their business; but the rejected candidates remain suitors for wages. The brass-founders say, "You shan't share with us;" and they are obliged therefore to go elsewhere, and diminish the share of each there, &c.

(3.) That where great wealth on the part of some is accompanied by great poverty on the part of others, the wealth is not the cause of the poverty, but it is the means by which the poverty may be relieved in the present, and a recurrence of it prevented in the future.

(4.) That the existence in a nation of abundance of capital is a good thing for those who are seeking wages.

(5.) That the art of making a profit is benefit, not only to the capitalist, but to the workman, in as much as it tends to secure to them a continuity of work.

(6.) That the increase by a skilful capitalist of his plant and machinery is a good thing for his workmen, in as much as it shows he has been making a profit, is prepared to undertake the payment of wages in greater quantity than heretofore, and is a guarantee of continuous employment to the workman.

(7.) That quarrels and hostile combinations either of masters or workmen lower profit, decrease capital, and lower wages.

(8.) That honest and intelligent co-operation between them increase profit, and, with economy, increase capital and increase wages; and that this benefit to both masters and men is gained by their joint work benefiting us all.

To conclude:—The examination of the various questions with which I have crowded this lesson should be done *at school.* The boy has time to go over the whole ground, guided, of course, by his teacher, and he has a comparatively unprejudiced mind. The young workman, as he shakes hands with his teacher on quitting school for the workshop, should know whether these things be true or false; and, if true, he should start with some such feeling produced by his school teaching as this: I will acquire the skill and the character necessary for getting the best wages that are to be had in that occupation which my parents have procured for me. I will save that I may be a self dependent man, and may, as far as in me lies, increase the wages fund. I will heartily endeavour so to work that when hereafter I look back upon my success, I may trace out that I have been doing good to others in getting good for myself, and I will earnestly, by my conversation, influence, and example, try so to lead, especially the young of my order, that the virtues of workmen may no longer be obscured by the envy, malice, and uncharitableness which they now exercise towards both their masters and each other.

IV. MONEY.

Origin and Nature of Money.—In a rude state of society, exchanges are made by bartering one article for another, according to some kind of understood value. "But when the division of labour first began to take place," says Adam Smith, "this power of exchanging must frequently have been very much clogged and embarrassed in its operations. One man, we shall suppose, has more of a certain commodity than he himself has occasion for, while another has less. The former, consequently, would be glad to dispose of, and the latter to purchase, a part of this superfluity. But if this latter should chance to have nothing that the former stands in need of, no exchange can be made between them. The butcher has more meat in his shop than he himself can consume, and the brewer and the baker would each of them be willing to purchase a part of it; but they have nothing to offer in exchange, except the different productions of their respective trades, and the butcher is already provided with all the bread and beer which he has immediate occasion for. No exchange can in this case be made between them. He cannot be their merchant, nor they his customers; and they are all of them thus mutually less serviceable to one another. In order to avoid the inconvenience of such situations, every prudent man in every period of society after the first establishment of the division of labour, must naturally have endeavoured to manage his affairs in such a manner as to have at all times by him, besides the peculiar produce of *his own* industry, a certain quantity of some one commodity or other, such as he imagined few people would be likely to refuse in exchange for the produce of *their* industry.

"Many different commodities, it is probable, were successively both thought of and employed for this purpose. In the rude ages of society, cattle are said to have been the common instrument of commerce ; and though they must have been a most inconvenient one, yet in old times we find things were frequently valued according to the number of cattle which had been given in exchange for them. The armour of Diomede, says Homer, cost only nine oxen ; but that of Glaucus cost a hundred oxen. Salt is said to be the common instrument of commerce and exchanges in Abyssinia ; a species of shells in some parts of the coast of India ; dried cod at Newfoundland ; tobacco in Virginia ; sugar in some of our West India colonies ; hides or dressed leather in some other countries ; and there is at this day a village in Scotland where it is not uncommon, I am told, for a workman to carry nails instead of money to the baker's shop or the alehouse.[1]

"In all countries, however, men seem at last to have been determined by irresistible reasons to give the preference for this employment to metals above every other commodity. Metals can not only be kept with as little loss as any other commodity, scarce anything being less perishable than they are, but they can likewise, without any loss, be divided into any number of parts, and by fusion those parts can easily be reunited again—a quality which no other equally durable commodities possess, and which, more than any other quality, renders them fit to be the instruments of commerce and circulation. The man who wanted to buy salt, for example, and had nothing but cattle to give in exchange for it, must have been obliged to buy salt to the value of a whole ox or a whole sheep at a time. He could seldom buy less than this, because what he was to give for it could seldom be divided without loss ; and if he had a mind to buy more, he must, for the same reasons, have been obliged to buy double or treble the quantity—the value, to wit, of two or three oxen, or of two or three sheep. If, on the contrary, instead of sheep or oxen, he had metals to give in exchange for it, he could easily proportion the quantity of the metal to the precise quantity of the commodity which he had immediate occasion for.

"Different metals have been made use of by different nations for this purpose. Iron was the common instrument of commerce among the ancient Spartans ; copper among the ancient Romans ; and gold and silver among all rich and commercial nations.

"Those metals seem originally to have been made use of for this purpose in rude bars, without any stamp or coinage. Thus

[1] In the middle of last century.

we are told by Pliny, upon the authority of Timæus, an ancient historian, that till the time of Servius Tullius, the Romans had no coined money, but made use of unstamped bars of copper to purchase whatever they had occasion for. These rude bars, therefore, performed at that time the functions of money.

"The use of metals in this rude state was attended with two very considerable inconveniences: first with the trouble of weighing; and, secondly, with that of assaying them. In the precious metals, where a small difference in the quantity makes a great difference in the value, even the business of weighing with proper exactness would require at least very accurate weights and scales. The weighing of gold, in particular, is an operation of some nicety. In the coarser metals, indeed, where a small error would be of little consequence, less accuracy would no doubt be necessary; yet we should find it excessively troublesome if, every time a poor man had occasion either to buy or sell a farthing's worth of goods, he was obliged to weigh the farthing. The operation of assaying is still more difficult, still more tedious; and unless a part of the metal is fairly melted in the crucible, with proper dissolvents, any conclusion that can be drawn from it is extremely uncertain. Before the institution of coined money, however, unless they went through this tedious and difficult operation, people must always have been liable to the grossest frauds and impositions; and instead of a pound-weight of pure silver or pure copper, might receive in exchange for their goods an adulterated composition of the coarsest and cheapest materials, which had, however, in their outward appearance, been made to resemble those metals. Accordingly, to prevent such abuses, to facilitate exchanges, and thereby to encourage all sorts of industry and commerce, it has been found necessary, in all countries that have made any considerable advances towards improvement, to affix a public stamp upon certain quantities of such particular metals as were in those countries commonly made use of to purchase goods. Hence the origin of *coined money*, and of those public offices called Mints—institutions exactly of the same nature with those of the aulnagers and stamp-masters of woollen and linen cloth. All of them are equally meant to ascertain, by means of a public stamp, the quantity and uniform goodness of those different commodities when brought to market."[1]

It will be understood from these explanations that money is

[1] Smith's *Wealth of Nations*, book i. chap. 4.

only an article which can be conveniently used in exchanging. It is in this, and in nothing else, that its usefulness lies.

Money being useful only as an instrument for effecting exchanges, it follows that the world does not become possessed of a large quantity of those useful and agreeable things that really form wealth, by merely having more money to employ in making exchanges among them. But money being, from many causes, closely associated to the mind with wealth, it has not unnaturally been imagined that the more money a nation could draw to itself and retain, the more prosperous and satisfactory its condition. Hence exports of goods, for which money would be imported, were encouraged, and imports of goods which would have drawn money away, were discouraged. It was overlooked that the money itself was useful only as a convenient means of obtaining other commodities, and that it must be advantageous to a nation to part with its money for commodities which it wanted, when it could get them cheaper from abroad than it could produce them at home. It used to be said that we can only establish a profitable trade when we pay in our own manufactures. Now, paying in gold is, after all, indirectly paying with our own manufactures, for—except the comparatively trifling quantity that may have been taken in war, or that may have been brought home in their own possession by persons who had gone as diggers to the gold countries—there is not an ounce of bullion in the country that has not been obtained in exchange for some article produced either by our manufacturing or agricultural industry. Let him who doubts this position, try if he can discover any other method by which gold can have found its way to this country.

V. PROTECTION.[1]

Mr. Prohibitor, a gentleman in France, employed his time and his capital in converting into iron the mineral of his estates. As nature had been more liberal towards the Belgians, they supplied iron to the French cheaper than Mr. Prohibitor; that is to say, France, or all the French, could obtain a given quantity of iron *with less labour*, by purchasing it from the honest Flem-

[1] This lesson and those which follow are from Dr. W. B. Hodgson's translation of Bastiat's *What is Seen and what is not Seen.*

ings. Thus, guided by their interest, they did not complain of this; but every day witnessed a multitude of nailers, smiths, cartwrights, machinists, farriers, and workmen, on their way, personally, or represented by middlemen, to provide themselves in Belgium. This, however, very much displeased Mr. Prohibitor.

At first he thought of stopping this abuse by his own strength. This was, indeed, the best that could be done, as he alone suffered. I will take my musket, he said to himself, I will stick four pistols in my belt, I will fill my cartridge-box, I will gird on my trusty sword, and thus equipped, I will make for the frontier; and there, the first smith, nailer, farrier, machinist, or locksmith that may present himself, on his own business, and not mine, I will kill him to teach him how to live.

At the moment of setting out, Mr. Prohibitor made some reflections which tempered a little his warlike ardour. He said to himself:—In the first place, it is not absolutely impossible, that the buyers of iron, my fellow-countrymen and enemies, may take my doings amiss, and instead of allowing me to kill them, may kill me. In the second place, even if I were to take with me all my servants, we could not guard all the passages. Finally, the proceeding would cost me very dear, dearer than the result is worth.

Mr. Prohibitor was sorrowfully about to resign himself to being simply free like every one else, when a bright thought flashed across his brain.

He remembered, that at Paris there is a great manufactory of laws. What is a law? he said to himself. It is a measure to which, when once decreed, be it good or bad, all are obliged to conform. For the execution of a law, a public force is organized, and to constitute the said public force, men and money are taken from the nation.

If, then, I obtained from the great Parisian law-factory a little law to this effect, "Belgian iron is prohibited," I should obtain the following results:—The government would, instead of the few servants whom I wished to send to the frontier, send twenty thousand sons of my refractory blacksmiths, locksmiths, nailers, farriers, artisans, machinists, and labourers. Next, in order to keep in good condition of health and spirits, these 20,000 custom-house guards, government would distribute among them 25 millions of francs, taken from those same blacksmiths, nailers, artisans, and labourers. The guard would be all the more effective; it would cost me nothing; I should not be exposed to the brutality of hagglers about price; I should sell my iron *on my own terms;* and I should enjoy the sweet satisfaction of seeing our great nation ingloriously mystified. That would teach it to proclaim itself incessantly the precursor and promoter of all progress in Europe. The game will be exciting, and is well worth the attempt.

M. Prohibitor repaired accordingly to the manufactory of laws. I may, some other time, tell the story of his secret negotiations; but at present I will speak only of his ostensible proceedings. He addressed to the honourable law-makers the following considerations:—

"Belgian iron is sold in France at ten francs, and this obliges me to sell mine at the same price. I should greatly prefer to sell mine at fifteen, and I cannot on account of this Belgian iron. Construct a law which shall say, 'Belgian iron shall no longer enter France.' Immediately I shall raise my price five francs, and see the consequences:—

"For every hundredweight of iron that I shall sell to the public, instead of receiving ten francs, I shall receive fifteen; I shall become rich all the sooner; I will enlarge my works, I will employ more workmen. My workmen and I will expend more, to the great advantage of all who supply us for many leagues round. These, too, having a greater demand for their products, will give greater employment to industry, and by degrees activity will be diffused through the whole country. This blessed five-franc piece which you will drop into my strong box, will, like a stone thrown into a lake, spread to a distance an infinite number of concentric circles."

Charmed by this discourse, enchanted to learn that it was so easy by legislation to increase the wealth of a nation, the fabricators of laws voted Protection. Why speak of labour and economy? they said. What avail those toilsome means of augmenting the national riches when a decree suffices?

And, in fact, the law had all the consequences announced by Mr. Prohibitor; only it had others also, for, to do him justice, he had not made a *false* reasoning, but a reasoning *incomplete.* In demanding a privilege, he had pointed out the effects *which are seen,* leaving in the shade those *which are not seen.* It is for us to repair this defect of memory, involuntary or designed.

Yes, the five francs thus diverted by legislation towards the strong box of Mr. Prohibitor, constitute an advantage for him and for those whose labour he encourages. And if the decree had brought that crown down from the moon, those good effects would not have been counterbalanced by any compensating bad effects. Unhappily, it is not from the moon that the mysterious five-franc piece proceeds, but in truth from the pockets of a smith, a nailer, a cartwright, a farrier, a labourer, a builder, in a word, of James Goodfellow, who now gives it without receiving an ounce of iron more than when he paid ten francs. At the first glance, it must be perceived that the question is thus greatly changed, for, very clearly, the profit of Mr. Prohibitor is compensated by the loss of James Goodfellow, and all that Mr. Prohibitor will be able to do with that five-franc piece for the encouragement of national industry, James Goodfellow would have done himself. The stone is thrown into the lake at one point only, because by law it has been prevented from being thrown in at another.

Let us state the case both before and after the issuing of the supposed decree. James Goodfellow is possessed of fifteen francs, the reward of his labour. What does he do with these fifteen francs? Mr. Prohibitor being obliged by Belgian competition to sell his iron at ten francs, James Goodfellow buys from him a hundredweight of iron for that sum, and still retains five francs. He does not throw them into the river, but (*and this is what is not seen*) he transfers them to some branch of industry in exchange for some enjoyment,—for example, to a bookseller, for Bossuet's *Discourse on Universal History.* Thus, as regards the national industry, it is encouraged to the extent of fifteen francs, namely, ten francs which go to the iron-master, five francs which go to the bookseller; and as regards James Goodfellow, he obtains for his sum of fifteen francs two objects of satisfaction, namely, 1st, a hundredweight of iron; 2d, a book.

But it will be said—"You assume that James Goodfellow buys the iron from Mr. Prohibitor. Were he, however, to buy the Belgian iron, would not the French national industry lose precisely what the Belgian national industry gained?" The answer is easy: "Not so; the Belgian, no more than the Frenchman, gives his iron for nothing (though if he did, would that be a calamity?), he demands an equivalent in exchange; all exchange is of product against product; and whether directly in the form of French goods, or indirectly in the form of money, which has been obtained, as only it can, by the previous sale of French goods, the Belgian receives in exchange for his iron, precisely as does Mr. Prohibitor, some one or other product of French industry. In the one case. as in the other, the national industry is encouraged to the extent of fifteen francs."

But the decree is issued. What, then, is the condition of James Goodfellow? What is that of the national industry? James Goodfellow, who delivers his fifteen francs, to the last centime, to Mr. Prohibitor, in exchange for a hundredweight of iron, has no more than the enjoyment of that hundredweight of iron: he loses five francs. This is obvious. It cannot be denied that, when Protection raises the price of articles, the consumer loses the difference. Neither does the national industry gain it. For, after the decree, as before, it can be *at most* (with a reserve to be yet made) encouraged only to the extent of fifteen francs; five of which, in the one case, are employed by James Goodfellow, for his own satisfaction, and in the other, transferred to Mr. Prohibitor for his. Thus *what is not seen*, *at least* compensates *what is seen;* and up to this point there remains as residue of the operation, an injustice—and, alas! an injustice perpetrated by the law.

But this is not all. There is the multitude of preventive officers to be maintained, not in any useful, or even harmless employment, but for the sole purpose of forbidding the passage of Belgian iron across the French frontier. Even were the cost borne by Mr. Prohibitor, for whose sole advantage the exclusion is enforced, this would be a loss. The cost, however, is borne, not by Mr. Prohibitor, but by the community, who thus (in addition to the loss of a mass of industry that ought to be productive) suffer doubly: *first*, in the enhanced price of iron; *second*, in the taxes levied in order to enforce this very enhancement. There is a twofold injustice, and to James Goodfellow a twofold loss. And even if his first loss, caused by the advanced price of iron, were fully compensated as regards the national industry (waiving the question of injustice) by the increased gain of Mr. Prohibitor, and his consequently increased employment of the national industry,—the second, at least, is pure, uncompensated, and national loss. This again is *what is not seen*, though surely it is important that it should be seen. And, be it once for all observed, that what is true of absolute *exclusion*, is true, *in degree*, of *protection* in every form, however modified, and under whatever plausible name it may assume.

The violence which Mr. Prohibitor himself employs at the frontier, or which he causes the law to employ for him, may be judged very differently in its moral aspect. There are persons who think that spoliation loses all its immorality provided it be legal. For my part, I can imagine no circumstance of greater aggravation. But, however that may be, certain it is that the economic results are always bad. Turn the matter over how you will, but look keenly, steadily, and you will see that no good issues from spoliation, legal or illegal. To use violence is not to produce, it is to destroy. Alas! if violence were production, this France of ours would be much richer than she is!

VI. ECONOMY AND LUXURY.

There is not a father of a family who does not make it a duty to teach his children order, arrangement, carefulness, economy, and moderation in expenditure. There is not a religion which does not thunder against pomp and luxury. This is very well; but, on the other side, what is there more popular than such remarks as these? "To store, is to dry up the veins of the people: the luxury of the great makes the comfort of the small; prodigals ruin themselves, but they enrich the state; it is on the superfluity of the rich that the bread of the poor grows."

Here, assuredly, is a flagrant contradiction between the moral idea and the social idea. How many men are there, men not without intelligence, who, after having remarked this incongruity, yet rest in peace? This is what I have never been able to comprehend: for it seems to me, that there can be nothing more painful than to perceive two incompatible tendencies in humanity. Can it be that both alike degrade humanity? Economy sinks it into misery; prodigality hurls it into the abyss of demoralization!

It is well that the vulgar maxims show economy and luxury in a false light, by reckoning only the immediate effects, *which are seen*, and not the ulterior effects, *which are not seen*. Let us endeavour to rectify this incomplete view.

Mondor and his brother Ariste, having divided their paternal inheritance, have each an income of £2500 a year. Mondor practises the fashionable philanthropy. He scatters his money right and left. He renews his furniture several times a year; changes his equipages every month; men quote the ingenious devices to which he has recourse to get through his wealth; in a word, he eclipses the most extravagant heroes of Balzac and Alexander Dumas.

Well, you should hear the concert of panegyrics with which he is always surrounded! "Tell us about Mondor! Long live Mondor! He is the benefactor of the workmen; he is the providence of the people. It is true he wallows in luxury, he bespatters the passers by with mud; his dignity and that of humanity suffer some little; but what does it signify? If he is not useful in himself, he is useful by his fortune. He makes money circulate; his hall is always filled with tradesmen, who always retire contented. Is it not said that if gold is round, it is that it may roll?"

Ariste has adopted a very different plan of life. If he is not an egotist, he is, at least, an "*individualist*," for he reckons his expenses, he seeks only moderate and reasonable enjoyments, thinks of the future, of his children, and, to speak plainly, he *economizes.*

And you should hear what the vulgar say of him! "What is the good of this rich niggard, this skin-flint? Doubtless there is something imposing and touching in the simplicity of his life; he is, besides, humane, beneficent, generous, but he *calculates.* He does not spend his income. His house is not always in a glitter and a fluster. What gratitude can he earn amongst upholsterers, coach-makers, jockeys, and confectioners?"

These judgments, so fatal to morality, are founded on this, that there is here something which strikes the eye—the outlay of the prodigal; and something else which escapes the eye—the outlay, equal and even greater, of the economical.

But things have been so admirably arranged by the divine Inventor of the social order, that in this, as in everything, political economy and morality, far from being hostile, are perfectly agreed; and the prudence of Ariste is not only more noble, but even more *profitable*, than the folly of Mondor.

And when I say more profitable, I do not mean only profitable to Ariste, or even to society in general, but more profitable to existing workmen—to the industry of the day.

To prove this, it suffices to place before the mind's eye the hidden consequences of human actions, which the bodily eye does not see.

Yes, the prodigality of Mondor has effects visible to all; every one can see his Berlins, his landaus, his phaetons, the delicate painting of his ceilings, his rich carpets, the dazzling lights in his palace, which rival the day. Every one knows that his thorough-breds run on the turf. The dinners which he gives at the Hôtel de Paris gather a crowd on the Boulevard, and people say to each other, "He is a capital fellow this, who, far from saving anything from his income, most likely makes a hole in his capital." *This is what is seen.*

It is not so easy to see, as regards the interests of workmen, what becomes of the revenues of Ariste. Let us trace them, nevertheless, and we shall be convinced, that all, *even to the uttermost farthing*, go to employ workmen, as certainly as the revenues of Mondor. There is only this difference: the *foolish* outlay of Mondor is doomed to decrease incessantly, and to come to an inevitable end; the *wise* outlay of Ariste will go on increasing from year to year.

And it is thus, assuredly, that the public interest is in harmony with morality.

Ariste spends, for himself and his household, a thousand pounds a year. If that were not enough for his happiness he would not deserve the name of wise. He is touched with the evils which weigh on the poor; he believes himself bound in duty to do something for their relief, and he consecrates £500 to acts of beneficence. Among merchants, manufacturers, agriculturists, he has friends whose means are straitened for a time. He acquaints himself with their position, in order to come to their aid prudently and efficiently; and to this employment he destines other £500. Finally, he does not forget that he has daughters to endow,—sons, to whom he ought to secure a future; and, consequently, he imposes on himself the duty of saving and investing every year £500. This, then, is the employment of his income:—

1*st*, Personal Expenses, . .	£1000
2*d*, Works of Beneficence, . .	500
3*d*, Friendly Service, . .	500
4*th*, Savings, ...	500

Let us consider each of those heads, and we shall see that not a single farthing escapes from the national industry. 1*st*, Personal

Expenses. These, as to workmen and furnishers, have effects absolutely identical with those that follow an equal expense on the part of Mondor. That is self-evident; let us speak no more of it.

2d, Beneficence. The £500 devoted to this purpose go equally to encourage industry; they make their way to the baker, the butcher, the clothier, and the furniture dealer. Only the bread, the meat, the clothes, do not directly serve Ariste, but those whom he has put in his place. Now, this simple substitution of one consumer for another does not at all affect the general industry. Whether Ariste spend five shillings himself, or request a man in need to spend them for him, the issue is the same.

3d, Friendly Services. The friend to whom Ariste lends or gives £500 does not receive them to hide them in the ground; this is inconsistent with the very case supposed. He employs them to buy merchandise or to pay his debts. In the first case, industry is encouraged. Will any one venture to say that there is more advantage in Mondor's purchase of a thorough-bred horse for £500, than in Ariste's, or his friend's, purchase of £500 worth of stuffs? But if this sum be employed to pay a debt, all that results is, that a third person comes upon the stage, the creditor, who will receive the £500, but who will certainly employ them in some way in his trade, his workshop, or his manufactory. He is one more intermediary between Ariste and the workmen. The proper names change, the expenditure remains, and the encouragement to industry also.

4th, Savings. There remain the £500 *saved;* and it is here that as regards the encouragement of the arts, of industry, of labour, of workmen, Mondor *appears* greatly superior to Ariste, though, from the moral point of view, Ariste shows himself superior to Mondor.

It is never without a sense of even physical uneasiness, little short of pain, that I see the appearance of such contradictions among the great laws of nature. If humanity were obliged to choose between two courses, of which one offends its interests, and the other its conscience, it would remain for us only to despair of its future. Happily, it is not so. And to recognise the economic, as well as the moral superiority of Ariste, it suffices to comprehend this consoling axiom, which is not the less true that it has the aspect of a paradox: *To save is to spend.*

What is the object of Ariste in saving £500? Is it that he may bury five hundred gold pieces secretly in his garden? No, assuredly; he wishes to enlarge his capital and his revenue. In consequence, that money which he does not spend on personal gratifications he employs in purchasing lands, a house, government stock, shares in industrial enterprises, or he places it with a merchant or a banker. Follow the shillings in each and all of these suppositions, and you will be convinced that through the intervention of sellers or borrowers they go to maintain industry just as surely as if Ariste, after his brother's example, had exchanged them for furniture, jewellery, or horses.

For, when Ariste buys land or stock for £500, he is moved by the consideration that he does not need to spend that sum, this being the very thing which you make into a charge against him.

But, in the same way, the person who sells him the land or the stock is moved by this consideration, that he needs to spend the £500 in some other manner.

Thus, in every case, the expenditure is made, either by Ariste or by those who take his place; and as regards the working classes and the encouragement of industry, there is only one difference between the conduct of Ariste and that of Mondor. The expenditure of Mondor being made directly by him and around him, *it is seen.* That of Ariste being made in part by intermediaries and at a distance, *it is not seen.* But in truth, and for him who knows how to connect effects with causes, that which is not seen is as certain as that which is seen. What proves it is, that in both cases the money *circulates.* It remains in the strong box of the prudent no more than in that of the spendthrift.

It is then false to say that economy does an actual wrong to industry. In this respect it is quite as beneficial as luxury.

But how vast is its superiority, if in thought, instead of looking only to the passing hour, we embrace a long period.

Ten years have passed away. What has become of Mondor and his fortune, and his great popularity? All has disappeared: Mondor is ruined;—far from diffusing £2500 yearly throughout the social body, he is perhaps a charge upon it. In any case, he no longer is the joy of his tradesmen; he is no longer reckoned as a promoter of the arts and of industry; he is good for nothing to the working classes, any more than to his family, whom he leaves in distress.

At the end of those same ten years, not only does Ariste continue to throw all his revenues into circulation, but revenues which go on increasing year by year. He increases the national capital —that is to say, the fund which supplies wages; and, as it is on the existence of this fund that the demand for labour depends, he helps to increase progressively the remuneration of the working class. When he dies, he leaves behind him children whom he has qualified to take his place in this work of progress and of civilisation.

In a *moral* point of view, the superiority of economy over luxury is incontestable. It is consoling to think that it is so in the *economic* view also for whosoever, not stopping at the immediate effects of phenomena, can push his investigations to their final issues.

VII. RIGHT TO LABOUR: RIGHT TO PROFIT.

"My brothers, subscribe to furnish me with work at your price." This is the right to labour; socialism elementary, or in the first stage.

"My brothers, subscribe to furnish me with work at my price." This is the right to profit; socialism refined, or in the second stage.

Both live by those of their effects *which are seen.* They will die through those of their effects *which are not seen.*

What is seen, is the labour and profit stimulated by the social contribution. *What is not seen,* is the labour and the profit which this same contribution would create, if it were left in the hands of those who pay it.

In France in 1848, the right to labour showed itself for a moment under two aspects. That was enough to ruin it in public opinion.

One of its faces was called, *National Workshop;* the other, *Tax of* 45 *Centimes* (4½d.)

Millions of francs proceeded every day from the Ministry of Finance to the national workshops. That is the fair side of the medal. But behold the reverse. In order that millions should issue from a box, it is needful that they enter it first. Therefore it was that the organizers of the right to labour addressed themselves to the taxpayer.

Now, the farmer said: "I must pay 45 centimes. I shall then, be deprived of a garment; I shall not manure my field; I shall not repair my cottage." And the workmen in the country said: "Since the farmer deprives himself of a garment, there will be less work for the tailor. Since he does not manure his field, there will be less work for the farm-labourer. Since he does not repair his house, there will be less labour for the carpenter and the mason."

It was then proved that two grists cannot be taken from one sack, and that the labour paid by the Government is effected at the expense of the labour paid by the taxpayer. This was the death of the right to *labour*, which proved itself a chimera, as well as an injustice.

And nevertheless the right to *profit*, which is only the exaggeration of the right to labour, still lives, and is in marvellous health.

Is there not something shameful in the part which the *protectionist* plays in society? He says to it: "You must give me work, and what is more, lucrative work. I have foolishly chosen an employment which leaves me a loss of ten per cent. If you levy a tax of twenty francs on my countrymen, and pay the amount to me, my loss will be converted into profit. Now, profit is a right; you owe me it."[1]

The society which listens to this sophist, which loads itself with taxes for his satisfaction, which does not perceive that the loss sustained by one branch of industry is not the less a loss because others are forced to make it up,—such a society, I say, well deserves the burden inflicted on it.

Thus, it appears, by the numerous subjects which we have passed in review, that not to know social economy, is to allow one's-self to be dazzled by the immediate effect of a phenomenon—to be the victim of delusions; to know it is to embrace in thought and by foresight the sum-total of its effects.

[1] While these sheets are passing through the press, I observe the following statement in the *Times* of the 12th July 1859 (City Article):—"An inquiry lately instituted by the Council of State on the subject of the duties imposed on foreign combed wool imported into France has inflicted a severe blow on the Protectionists. The result of the inquiry has demonstrated that in consequence of the duty imposed on foreign wool, 10,000 inhabitants are prevented from procuring woollen clothing."—*Translator* (1859).

We shall conclude by applying to political economy what Chateaubriand says of history :—"There are," says he, "two consequences in history ; one immediate and observed at the instant ; the other distant and not at first perceived. These consequences are often contradictory ; the first class arises from our brief wisdom, the second from the wisdom everlasting. The providential event appears after the human event. God rises behind men. Deny as much as you will the supreme wisdom, admit not its action, dispute about words, call that 'force of things,' or 'reason' which others call Providence, but look to the end of an accomplished deed, and you will see that it always produces the reverse of what was expected from it, when it has not been at first founded on morality and justice."

LESSONS ON LAW, PROPERTY, AND THE CONSTITUTION.

Of Security.—(Jeremy Bentham.)

This inestimable good is the distinctive mark of civilisation ; it is entirely the work of the laws. Without law there is no security ; consequently no abundance, nor even certain subsistence. And the only equality which can exist in such a condition is the equality of misery.

In order rightly to estimate this great benefit of the laws, it is only necessary to consider the condition of savages. They struggle without ceasing against famine, which sometimes cuts off, in a few days, whole nations. Rivalry with respect to the means of subsistence produces among men the most cruel wars ; and, like the most ferocious beasts, men pursue men, that they may feed on one another. The dread of this horrible calamity destroys amongst them the gentlest sentiments of nature : pity connects itself with insensibility in putting the old persons to death, because they can no longer follow their prey.

Examine also, what passes at those periods, during which civilized societies almost return into the savage state ;—I refer to a time of war, when the laws which give security are in part suspended. Every instant of its duration is fruitful in calamity : at every step which it imprints upon the globe, at every movement which it makes, the existing mass of riches—the foundation of abundance and subsistence—is decreased, and disappears : the lowly cottage and the lofty palace are alike subject to its ravages ;

and often the anger or caprice of a moment consigns to destruction the slow productions of an age of labour.

The law does not say to a man, "*Work, and I will reward you;*" but it says to him, "*Work*, and, by stopping the hand that would take them from you, *I will insure to you the fruits of your labour*, its natural *and sufficient reward, which without me, you could not preserve.*" If industry creates, it is the law which preserves; if at the first moment, we owe everything to labour, at the second and every succeeding moment, we owe everything to the law.

In order to form a clear idea of the whole extent which ought to be given to the principle of security, it is necessary to consider that man is not like the brutes, limited to the present time either in enjoyment or suffering; but that he is susceptible of pleasure and pain by anticipation, and that it is not enough to guard him against an actual loss, but we must also guarantee to him, as much as possible, his possessions against future losses. The idea of his security must be prolonged to him throughout the whole vista that his imagination can measure.

North America presents the most striking contrast of a state of society with and without law, and the security which it gives: savage nature is there placed by the side of civilisation. The interior of this immense region presents only a frightful solitude; impenetrable forest or barren tracts, standing waters, noxious exhalations, venomous reptiles—such is the land left to itself. The barbarous hordes who traverse these deserts, without fixed habitation, always occupied in the pursuit of their prey, and always filled with implacable rivalry, only meet to attack and to destroy each other; so that the wild beasts are not so dangerous to man, as man himself. But upon the borders of these solitudes what a different prospect presents itself! One could almost believe that one saw, at one view, the two empires of good and evil. The forests have given place to cultivated fields; the morass is dried up; the land has become solid, is covered with meadows, pastures, domestic animals, smiling and healthy habitations; cities have risen up on regular plans; wide roads are traced between them; everything shows that men are seeking the means of drawing near to one another; they no longer dread or seek to murder each other. The sea-ports are filled with vessels receiving all the productions of the earth, and serving to exchange its riches. A countless multitude, living in peace and abundance upon the fruits of their labours, has succeeded to the nations of hunters who were always struggling between war and famine. What has produced these wonders? What has renovated the surface of the earth? What has given to man this dominion over embellished, fruitful, and perfectionated nature? The benevolent genius is *security.* It is security which has wrought out this great metamorphosis. How rapid have been its operations! It is scarcely two centuries since William Penn reached these savage wilds with a colony of true conquerors; for they were men of peace, who sullied not their establishment by force, and who made themselves respected only by acts of benevolence and justice.

THE ADVANTAGES OF THE INSTITUTION OF PROPERTY.[1]

The chief advantages connected with the institution of property are the following:—

I. *It increases the produce of the earth.*—The earth, in climates like ours, produces little without cultivation, and none would be found willing to cultivate the ground if others were to be admitted to an equal share of the produce. The same is true of the care of flocks and herds of tame animals.

Crabs and acorns, red deer, rabbits, game, and fish, are all which we should have to subsist upon in this country if we trusted to the spontaneous productions of the soil; and it fares not much better with other countries. A nation of North American savages, consisting of two or three hundred, will take up and be half starved upon, a tract of land which, in Europe, and with European management, would be sufficient for the maintenance of as many thousands.

In some fertile soils, together with great abundance of fish upon their coasts, and in regions where clothes are unnecessary, a considerable degree of population may subsist without property in land, which is the case in the islands of Tahiti.

II. *It preserves the produce of the earth to maturity.*—We may

[1] Abridged from Paley.

judge what would be the effects of a community of right to the productions of the earth, from the trifling specimens which we see of it at present. A cherry-tree in a hedgerow, nuts in a wood, the grass of an unstinted pasture, are seldom of much advantage to anybody, because people do not wait for the proper season of reaping them. Corn, if any were sown, would never ripen; lambs and calves would never grow up to sheep and cows, because the first person that met them would reflect that he had better take them as they are, than leave them for another.

III. *It prevents contests.*—War and want, tumult and confusion, must be unavoidable or eternal, where there is not enough for all, and where there are no rules to adjust the division.

IV. *It improves the conveniency of living.*—This it does in two ways. It enables mankind to divide themselves into distinct professions, which is impossible, unless a man can exchange the productions of his own art for what he wants from others; and exchange implies property. Much of the advantage of civilized over savage life depends upon this. When a man is from necessity his own tailor, tentmaker, carpenter, cook, huntsman, and fisherman, it is not probable that he will be expert at any of his callings. Hence the rude habitations, furniture, clothing, and implements of savages, and the tedious length of time which all their operations require.

It likewise encourages those arts by which the accommodations of human life are supplied, by appropriating to the artist the benefit of his discoveries and improvements, without which appropriation ingenuity will never be exerted with effect.

Upon these several accounts we may venture, with a few exceptions, to pronounce, that even the poorest and the worst provided in countries where property, and the consequences of property, prevail, are in a better situation, with respect to food, raiment, houses, and what are called the necessaries of life, than *any* are in places where most things remain in common.

THE BRITISH CONSTITUTION.—KING, LORDS, AND COMMONS.[1]

The British Constitution is what is called a limited monarchy, being the government of a hereditary king or queen, in conjunction with a parliament. If there were no parliament, and the regal power were unlimited, it would be an absolute monarchy, and if there were only a parliament it would be a republic. In consequence of both being found in co-existence, our government is said to be mixed.

The functions of government, that is, all that a government does for a people, are usually distributed under three heads, the *Legislative*, the *Executive*, and the *Judicial*.

To the Legislative branch of government belongs the enacting and repealing of laws ; to the Executive (or administrative) belongs the maintenance of public peace and good order, the directing of fleets and armies, in short, the execution of all that is required to be done from day to day for the public service ; to the Judicial branch of government belongs the deciding of causes between man and man, and the trying of persons accused of crime.

The Legislature.

The Legislative power exists with Parliament, that is, the Houses of Lords and Commons.

The House of Lords, or Upper House, is composed of the Spiritual and Temporal Peers.

The House of Commons consists of 658 members, chosen by the people as their representatives. Of these England and Wales are represented by 500, Ireland by 105, and Scotland by 53. The members are returned separately, by counties, cities, and boroughs. When a new Parliament has to be called together, "writs" are issued by the Lord Chancellor to the sheriffs of counties, and these again send orders to officers called "returning officers," commanding them to elect their members within eight days after receipt of the order.[2] On the day fixed, called the nomination-day, the candidates appear on a public platform, called the "hustings," and having been proposed and seconded by two

[1] Partly abridged and adapted from *Lessons on the British Constitution* (Parker).

[2] In counties sixteen days are allowed.

electors, they state their political views to the audience. On the following day those entitled to give a vote have it recorded in what are called the "*poll-books*," by clerks appointed for the purpose. The candidate who has the majority of votes is elected. Those who have a right to vote are called electors, and embrace all householders in cities and boroughs; in counties those *possessing* land of a certain value,[1] or holding farms or tenements above a certain rent, have the franchise.

At present the following have votes in the Upper House :—

(1.) *Spiritual Peers.*—Two archbishops of England and Wales and twenty-four bishops; one archbishop of Ireland and three bishops of Ireland. (2.) *Temporal Peers.*—Four royal princes, twenty dukes with British titles, nineteen marquises, one hundred and ten earls, twenty-two viscounts, two hundred and fifteen barons, twenty-eight peers of Ireland, elected for life, and sixteen peers of Scotland, elected for each Parliament; in all, four hundred and sixty-four lords.

Every law must originate in one of the two Houses of Parliament, and any member of either house may bring in a bill, that is, may propose a law. The only exception to this is, that all money bills, that is, bills for taxing the people, can originate in the House of Commons alone; and this power of regulating the expenditure gives them power over every department of the State.

Every bill must be read three times in both Houses, and when it has gone through these stages it receives the royal assent, and becomes the law of the land. After the second reading has been agreed upon it is brought before a committee of the whole House. This committee resembles an ordinary meeting of the House, with this difference, that the Lord Chancellor, who usually presides in the House of Lords, and the Speaker, who performs a similar duty in the Commons, are superseded by chairmen, and that members may speak more than once on the same subject.

In committee each clause of the bill is discussed separately, put to the vote, and passed, rejected, or altered.

The Executive.

The greater portion of the Executive work of government is

[1] In England all persons possessing freehold estate of the value of forty shillings per annum may vote.

performed by the sovereign, through ministers of state, possessing the confidence of Parliament.

The Premier, or Prime Minister, may hold any office, but he is generally appointed First Lord of the Treasury.

Any person whom the Sovereign commands to form a ministry (or administration, as it is often called), consults with his friends, and arranges with them what office shall be held by each of them, and what by himself; and if this arrangement receives the royal approbation, he is then considered the head, or Premier, of that ministry.

The Chief Secretaries of State distribute among themselves the different "departments" intrusted to them. Thus, you read of the Home Secretary, who provides for the internal peace and good order of the country; the Colonial Secretary, who attends to the affairs of the colonies; and the Foreign Secretary, who conducts all our intercourse with foreign nations.

The members of a ministry, or administration, in addition to the Premier, or First Lord of the Treasury, are—

The Lord High Chancellor, who is the law adviser.

The Lord President of the Privy Council, under whom is a Vice-President.

The Postmaster-General.

The Lord Privy Seal, who affixes the Great Seal to documents.

The Secretary of State for the Colonies.

The Secretary of State for Foreign Affairs.

The Secretary of State for the Home Department.

The Secretary of State for the War Department.

The Secretary of State for India.

The Chancellor of the Exchequer, who has to provide for the public expenditure, and account for it to Parliament.

The First Lord of the Admiralty, who presides over the affairs of the Royal Navy.

The President of the Board of Trade, who attends to matters relating to trade and commerce.

The Law Officers of the Crown, under the Lord Chancellor, are the Attorney-General, the Solicitor-General, and the Queen's Advocate.

Although the sovereign may ask any member of Parliament he pleases to form a ministry, it is impossible for them to conduct the

Government without being supported by a majority in Parliament, by whom consequently the ministry are virtually appointed.

Law—The Judicial Functions of Government.

The Judicial functions of the Sovereign are performed through Judges appointed by him.

Except in the Courts of Chancery (where a particular class of causes are decided) the Judge does not decide by himself, but instructs and guides a certain number of men, called the Jury, who are appointed to decide on the evidence.

In this way are tried causes belonging to two very different classes, and which it is important to distinguish clearly from each other; namely, the "*Civil*" and the "*Criminal*." The distinction between these is not artificial, but natural: that is, it is not established by the Constitution of any particular country, but exists in the nature of things. *Civil* causes are those between *man and man;* as where there is a dispute about some property or right, or where one man claims compensation according to law, from another, for some *damage* (or injury) done to him: whence the compensation claimed is commonly called "damages." The complaining party, that is, the one who "brings an action," as it is called, against another, is called the "Plaintiff" (in Scotland he is called the "Pursuer"), and the other the "Defendant." The cause is tried by the Jury, aided by the Judge, and a verdict is given, "*for the Plaintiff*," or "*for the Defendant.*"

Criminal causes are those in which a person is accused of some crime against the *Community*, for which the laws award a *punishment.* The accuser is called the "prosecutor," and he comes forward in the name of the King; that is, on behalf of the community of which the King is the supreme ruler. The verdict of the jury is "guilty" or "not guilty;" and the accused person is said to be "convicted" or "acquitted." In Scotland an intermediate verdict is allowed of "not proven."

There are many countries in the present day, in which any man is liable to be arbitrarily thrust into a dungeon, and condemned to the severest punishments, and even to death, without trial. With us, on the contrary, any man who thinks himself unjustly imprisoned may at once obtain, from any judge, an order (called a "Writ of Habeas Corpus") by which his jailor is compelled to bring him into open court, and explain why he is kept in custody.

Our people ought to think of all this when they are disposed to complain of the laws and government of our own country.

Any one is allowed, either in a criminal or a civil trial, to plead his own cause himself, if he chooses. But it is usual to employ "counsel;" that is, lawyers called "barristers" (in Scotland, "advocates"), from their being licensed to plead causes at the *bar* of the Court. He who employs such a counsel (or advocate) is called his "client."

The advocates on each side examine witnesses, and speak on behalf of their respective clients, urging all that can be said in their favour. And there usually are real and sound reasons on both sides; it is for the judge and juries to decide which are the stronger. The verdict of a jury—according to the English law—must be *unanimous;* that is, every one of the jurors must agree in it. And they are shut up together, without fire, food, or candle, till they are agreed. In Scotland a majority decides a case.

Several changes have been made at various times in several of our laws, and, among others, in those relating to the mode of conducting trials. No laws, or systems, of any kind, devised by man, can be expected to be quite perfect. And even laws which may be the very best at the time they are made, cannot be expected to continue equally suitable for ever and under all changes of circumstances. It is the duty of a good citizen to obey the laws that do exist, but to seek, in a regular manner, to have such improvements made as he is convinced, on very careful inquiry and reflection, are needful.

To make sound improvements, however, is a matter of much more difficulty, and one which requires much more care and ability than some persons suppose. Some particular evil or inconvenience will often appear very *easy* to remedy, and perhaps will really be so; and yet it may be very difficult indeed to find a remedy that will not produce some *different evil*, and perhaps a worse, in its stead. Just as an unskilful physician may cure a disease by medicines, which create a new disorder worse than that which has been got rid of.

ON THE BRITISH CONSTITUTION.[1]

The Government of England, which has been sometimes called a mixed government, sometimes a limited monarchy, is formed by a combination of the three regular species of government: the monarchy residing in the Sovereign, the aristocracy in the House of Lords, and the republic being represented by the House of Commons.

We will present a few remarks upon expedients by which the British Constitution provides for the interests of its subjects.

In order to promote the establishment of salutary public laws, every citizen of the state is capable of becoming a member of the senate, and every senator possesses the right of propounding to the deliberation of the legislature whatever law he pleases.

Every district of the empire enjoys the privilege of choosing representatives, informed of the interests and circumstances and desires of their constituents, and entitled by their situation to communicate that information to the national council.

The meanest subject has some one whom he can call upon to bring forward his complaints and requests to public attention.

The number, fortune, and quality of the members; the variety of interests and characters amongst them; above all, the temporary duration of their power, and the change of men which every new election produces,—are so many securities to the public, as well against the subjection of their judgments to any external dictation, as against the formation of a junto in their own body, sufficiently powerful to govern their decisions.

The representatives are so intermixed with the constituents, and the constituents with the rest of the people, that they cannot without a partiality too flagrant to be endured, impose any burden upon the subject in which they do not share themselves, nor scarcely can they adopt an advantageous regulation in which their own interests will not participate in the advantage.

The proceedings and debates of Parliament, and the parliamentary conduct of each representative, are known by the people at large through the press.

The representative is so far dependent upon the constituent, and political importance upon public favour, that a member of Parliament cannot more effectually recommend himself to emi-

[1] Abridged from Paley.

nence and advancement in the state, than by contriving and patronizing laws of public utility.

When intelligence of the condition, wants, and occasions of the people is thus collected from every quarter; when such a variety of invention, and so many understandings are set at work upon the subject, it may be presumed that the most eligible expedient, remedy, or improvement, will occur to some one or other; and when a wise counsel or beneficial regulation is once suggested, it may be expected from the disposition of an assembly so constituted as the British House of Commons is, that it cannot fail of receiving the approbation of a majority.

To prevent those destructive contentions for the supreme power, which are sure to take place where the members of the state do not live under an acknowledged head and a known rule of succession; to preserve the people in tranquillity at home by a speedy and vigorous execution of the laws; to protect their interest abroad by strength and energy in military operations, by those advantages of decision, secrecy, and despatch, which belong to the resolutions of monarchical councils;—for these purposes, the Constitution has committed the executive government to the administration and limited authority of a hereditary Sovereign.

In the defence of the empire; in the maintenance of its power, dignity, and privileges with foreign nations; in the advancement of its trade by treaties and conventions; and in providing for the general administration of municipal justice, by a proper choice and appointment of magistrates,—the inclination of the Sovereign and of the people usually coincides; in this part therefore of the regal office, the constitution intrusts the prerogative with ample powers.

The dangers principally to be apprehended from regal government, relate to the two articles *taxation* and *punishment.*

Accordingly, every law which, by the remotest construction, may be deemed to levy taxes upon the property of the subject, must originate, that is, must first be proposed and assented to, in the House of Commons. By this regulation the levying of taxes is almost exclusively reserved to the popular part of the Constitution, who, it is presumed, will not tax themselves, nor their fellow-subjects, without being first convinced of the necessity of the aids which they grant.

The application also of the public supplies, is watched with the

LESSONS ON BOTANY.

GENERAL DIVISION OF PLANTS.

A PLANT consists of certain parts which are called *organs.* The root, stem, and leaves are concerned in the nourishment of the plant, and are called *nutritive* organs ; while the flowers are connected with the production of seeds, and are denominated *reproductive* organs. Some plants produce flowers and seeds, and are called *flowering* or *phanerogamous* ;[1] while others do not produce flowers, but have peculiar organs which give origin to germs, equivalent to seeds, and they are hence called *flowerless* or *cryptogamous.*[2] To the former division belong our ordinary trees, shrubs, and herbaceous flowering plants ; to the latter belong ferns, mosses, lichens, sea-weeds, and mushrooms.

In flowering plants the seed contains the young or embryo plant, either alone, as in the bean, pea, and wallflower (Fig. 1), or associated with a separate store of nourishment, as in the coco-nut, the cereal grasses, and the pansy (Fig. 2). When the skin of a bean or pea is removed, the young plant is found within, consisting of the rudimentary root and stem, with two large lobes called *cotyledons* ; these cotyledons in the pea are

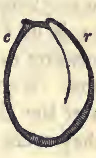


FIG. 1.[3]

FIG. 2.[4]

[1] Greek words *phaneros,* conspicuous, and *gamos,* reproduction.

[2] Greek words *cryptos,* inconspicuous, and *gamos,* reproduction.

[3] (Fig. 1.) Section of the seed of the common wallflower, showing the covering marked by a dark line, and the embryo or young plant inside, of a white colour, occupying the whole of the interior of the seed. On one side are seen the cotyledons or seed-lobes *c,* and on the other *r* the radicle or portion of the axis whence the root proceeds. A narrow dark line shows the folding of the radicle on the cotyledons.

[4] (Fig. 2.) The seed of the common pansy or heart's-ease, cut vertically with its point of attachment *h.* The dark outer lines indicate the coverings of the seed, the white body in the centre is the embryo plant with its two cotyledons *c o,* and its radicle *r,* and the dotted mass *a* surrounding it. is nourishing matter, stored up for the young plant.

thick and fleshy, and constitute the great bulk of the seed (Fig. 3). In the case of the coco-nut, the seed, which is contained within the hard shell, consists principally of a mass of nourishing matter (the white part used for food), in a cavity of which, at the end where the hole in the shell exists, the little embryo plant lies. The embryo is a small and somewhat club-shaped body : its parts are the rudimentary root, and the stem with a single cotyledon, which is wrapped round it (Fig. 4). In flowerless plants, in place of seeds little germs are formed, called *spores*,[3] which do not exhibit any separate parts and have no cotyledon (Fig. 5). Thus all the plants in the world are divided into three great classes, founded on the nature of their embryo, viz. :—1. *Dicotyledonous*[5] plants, having two cotyledons or seed-lobes or seed-leaves (Fig 6) ; 2. *Monocotyledonous*[6] plants, in which there is one cotyledon (Fig. 7) ; and 3. *Acotyledonous* plants[7] in which there is no cotyledon (Fig. 8). The first two divisions embrace flowering or phanerogamous plants, the last, flowerless or cryptogamous. Here we see a natural division of the vegetable productions of the globe, and we observe to some extent the plan on which they were formed by the Creator.

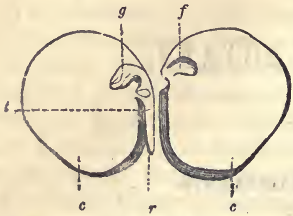


Fig. 3.[1]

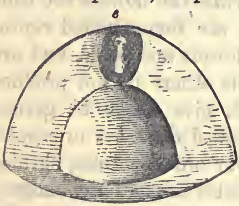


Fig. 4.[2]

Fig. 5.[4]

[1] (Fig. 3.) The embryo or young plant of the pea separated from the coverings of the seed. This embryo consists of two cotyledons or fleshy seed-lobes *c c*, which remain underground when the plant sprouts ; a general axis *t* to which the cotyledons are attached, and which gives origin to the radicle *r*, and the young ascending bud *g*, forming stem and leaves ultimately. The depression in which the young bud lies when the lobes are folded together, is marked *f*.

[2] (Fig. 4.) Section of a part of the seed of the coco-nut showing the abundant nourishing matter *p*, which constitutes the eatable white part of the seed, and the small club-shaped embryo plant *e*, lying in a cavity at one end ; the upper part is the radicle, and the lower is the young bud wrapped up in a single cotyledon.

[3] Greek word *spora*, seed or offspring.

[4] (Fig. 5.) Spore or cellular body, which represents the seed and embryo in flowerless plants. There is no cotyledon present.

[5] Greek words *dis*, twice, and *cotyledon*, a seed-lobe.

[6] Greek words *monos*, one, and *cotyledon*.

[7] Greek word *a*, meaning privation or absence, and cotyledon.

Sprouting of the Plant, or Germination.

When the seed is sown, and is subjected to the influence of moisture and a certain temperature, the embryo or young plant contained in it begins to sprout or germinate.[1] The little root (*r*, Fig. 2, p. 211) begins to project through a hole in the seed, and elongates so as to enter into the soil for the purpose of drawing nourishment for the plant. The cotyledons then either rise above the soil, as in the lupin and the common turnip, or they remain below ground, as in the common bean or pea. In the former case the cotyledons assume a green colour, and serve the purpose

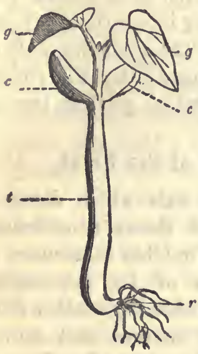


Fig. 6.[2]

Fig. 8.[4]

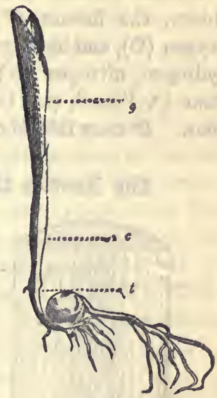


Fig. 7.[3]

of temporary leaves until the proper foliar or leafy organs are developed; in the latter case the nourishing matter contained in the cotyledons is gradually absorbed by the plant, and they shrivel up and finally disappear. If a bean-plant is pulled up some time after it has sprouted, the two cotyledons will be seen in a withered state at the bottom of the stalk. The germination of the plant is represented in Figs. 6, 7, and 8. In Fig. 6, we observe a French bean or haricot sprouting. In this case the

[1] Latin word *germinare*, to sprout.

[2] (Fig. 6.) Haricot or French bean germinating. A dicotyledonous plant.

[3] (Fig. 7.) Maize or Indian corn germinating. A monocotyledonous plant.

[4] (Fig. 8.) Spore of an acotyledonous plant germinating.

little roots *r*, coming off from the common axis *t*, descend into the ground; the axis ascends, bearing the two cotyledons *c c*, which serve a temporary purpose as seed-leaves; while from between the cotyledons rises the first stem-bud, bearing the proper leaves *g g*. In Fig. 7, we notice the sprouting of the maize or Indian corn. Here the common axis *t*, gives off the roots at the lower end, a single cotyledon *c*, and a stem-bud with ordinary leaves *g*. In Fig. 8, the spore or germ of an acotyledonous plant is represented giving off root-like filaments or threads *r r*, but having no cotyledons. The separate nutriment stored up in some seeds (Figs. 2, p. 211, 4, p. 212), is in the same way absorbed. This nutriment consists of certain organic substances, such as starch and gluten, the former of which may be resolved into carbon (C), oxygen (O), and hydrogen (H); and the latter into carbon, oxygen, hydrogen, nitrogen (N), and sulphur (S). The ascending axis or stem (*g*, Fig. 6, p. 213), makes its appearance after the cotyledons. It rises into the air and bears buds which produce leaves.

The Root or the descending axis of the Plant.

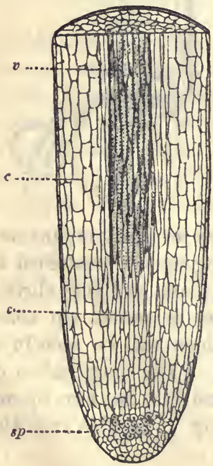


Fig. 9.[1]

The root is the axis which descends into the earth, and draws nourishment from the soil. It imbibes substances in solution by means of its extremities. These consist of minute bags called cells, which absorb fluid matters, and convey them upwards to the stem (Fig. 9). As plants have no power of locomotion, their food must be placed near them. Consequently they have all the materials required for their growth in the air and in the soil; the leaves being put into relation with the former, and the roots, with the latter. The gaseous and fluid matters of the atmosphere and earth are thus converted, by the agency of plants, into the solid herbage on which animals feed, and the nutritious matter of the cereal grains

[1] (Fig. 9.) Section of the end of a root highly magnified. The extreme point *s p*, consists of cells which are very delicate, and easily imbibe fluids; these are connected with other cells *c c*, and finally with tubes and vessels *v*.

which in part constitute the food of man. The ends of the roots are, as it were, little mouths, which are constantly extending through the soil in quest of food. A beautiful provision is made for this by the increase taking place always at the points, and thus, the delicate rootlets are enabled to accommodate themselves to all kinds of soil. The spreading of the roots and branches also bear a relation to each other, so that the rain dropping from the ends of the latter falls over the part of the ground where the absorbing parts of the roots are situated. These interesting phenomena display the wondrous providence of the all-wise Creator.

As the roots imbibe nourishing substances from the earth, it follows that they must by degrees exhaust the soil, and unless a renewal took place the plants would die. To provide against this, the rain, the atmosphere, and the sun, are constantly acting on the soil, and causing changes, which give rise to the production of additional nourishing matters. When man wishes to get a large supply of food in a short time he applies manures, and raises his crops by rotation, so as to secure the greatest amount of produce which the plants can yield. In some plants the roots, in place of descending directly into the soil, appear first in the air and then reach the earth. This is particularly seen in the banyan and other trees of the fig tribe, also in the screw-pines and mangroves. Occasionally, as in orchids of warm countries, the roots embrace other plants and never touch the ground. Some plants send their roots into the stems or roots of other plants, and derive their nourishment from them, as may be seen in the mistletoe, the dodder, and the broom-rape. These are true parasites.

The Stem or ascending axis of the Plant.

The stem usually rises into the air and bears leaf-buds. Sometimes it creeps along the surface of the ground, as in the iris, or it remains entirely underground, as in the asparagus, Solomon's-seal, and the banana. The characteristic of the stem is the provision made for the production of leaf-buds. The *eyes* of the potato are leaf-buds, and hence it is a kind of underground stem. The bulbs of lilies are underground buds, developed on underground stems, with the roots proceeding from their lower part. What are called the roots of tulips and crocuses are also subterranean thickened stems, producing buds at the upper part and roots below. While the root may be called the system connected with the soil and darkness, the stem may be said to be the system connected with air and light; it produces the leaves, and exposes them to those influences which are required for the preparation of the sap and the formation of various secretions, such as woody matter, starch, &c. The stem consists of cells, or small bladders, of various forms (Fig. 10), and of tubes, which usually

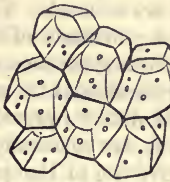


Fig. 10.[1]

Fig. 12[3]

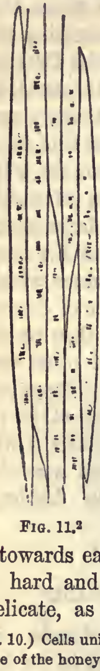


Fig. 11.[2]

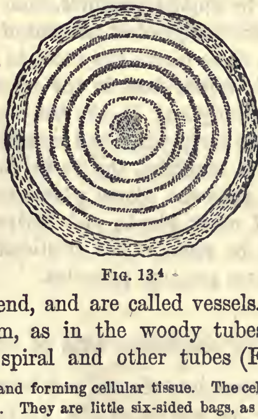


Fig. 13.[4]

taper towards each end, and are called vessels. These vessels are either hard and firm, as in the woody tubes (Fig. 11), or they are delicate, as in spiral and other tubes (Fig. 12), in which a

[1] (Fig. 10.) Cells united, and forming cellular tissue. The cells in this case are six-sided, like those of the honeycomb. They are little six-sided bags, as it were, containing various kinds of matter, according to circumstances.

[2] (Fig. 11.) Woody tubes overlapping each other, and constituting woody tissue. The tubes are spindle-shaped, that is, they taper at each end.

[3] (Fig. 12.) Spiral vessels, with a fibre coiled up in their interior, in a corkscrew-like manner.

[4] (Fig. 13.) Transverse section of the exogenous stem of an oak, showing cellular pith in the centre, six woody layers, forming consecutive circles round the pith, and the layers of bark outside. Immediately surrounding the pith spiral vessels occur, and the woody layers consist of woody tubes and of large vessels, having round markings on their walls, and hence called dotted or pitted vessels. The inner bark consists of woody tubes, the outer of cells. The pith and bark are united by various cellular rays.

thread is coiled up in the interior, in a more or less complete cork-screw like manner. In our ordinary trees the cells are found in the outer bark, in the pith, and in the rays which connect them; the woody tubes occur in the inner bark and in the proper wood of the stem; and the spiral vessels in the part immediately surrounding the pith. By means of the structure of the stem the whole vegetable kingdom is divided again into three great classes, viz.: 1. *Exogenous*[1] plants, in which there is a distinct separable bark and a pith, and in which the woody layers are developed in an outward direction, one over the other: this is seen in the common forest trees of Britain (Fig. 13). 2. *Endogenous*[2] plants, in which there is

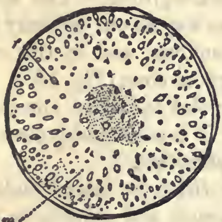


FIG. 14.[3]

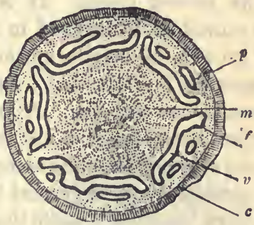


FIG. 15.[4]

no separable bark and no pith; the bundles of vessels are seen in the midst of a quantity of cellular tissue, and the additions are chiefly made towards the inside, as may be seen in palms (Fig. 14). 3. *Acrogenous*[5] plants, in which there is no separable bark nor pith; the vascular bundles have a peculiar irregular form, and the additions are chiefly made to the summit, as in ferns (Fig. 15). These divisions correspond with those already mentioned as founded on the embryo. Thus dicotyledonous plants have exogenous stems; monocotyledonous plants have endogenous stems; and acotyledonous plants have acrogenous stems. In some instances, plants produce mere expansions, composed of cells without any

[1] From two Greek words, *exo*, outwardly, and *gennaein*, to produce.

[2] *Endon*, inwardly.

[3] (Fig. 14.) Transverse section of the endogenous stem of a palm, showing cellular tissue *m*, and bundles of vessels *f*, scattered through it. The whole is enveloped by an outer covering, which is closely incorporated with the parts below.

[4] (Fig. 15.) Transverse section of the acrogenous stem of a tree-fern, showing cellular tissue in the centre *m*, and in the circumference *p*, with peculiar vascular bundles *f v*, and the bases of the leaves forming a sort of bark *c*.

[5] *Acra*, summit.

evident stem or vessels; such plants are called *cellular*, in contradistinction to the stem-producing plants, which are *vascular*.

An exogenous plant produces, during its first year of growth, a ring or circle of vascular bundles between the pith and bark. During the second year a second ring is formed inside the previous one; and so on year after year. It is an outward-grower. The oldest, most mature and hardest wood is in the interior of such a stem, and its age can be determined by counting these annual rings or layers (Fig. 13, p. 216). An endogenous stem (Fig. 14, p. 217) exhibits no rings. Its vascular bundles are developed towards the interior, so that the oldest, most mature, and hardest, are outside, and the newest inside. It is an inward-grower. The ages of palms cannot be determined in the same way as our ordinary trees. Their growth in height, however, is uniform, and by this means their ages can be estimated. An acrogenous stem (Fig. 15, p. 217) increases by its summit; its growing point is carried upwards by the union of the bases of the leaves. It is a summit-grower. A tree-fern stem exhibits the acrogenous structure.

Exogenous stems in general have provision for lateral buds, and these form branches; while the endogenous and acrogenous stems have usually no such provision, and hence do not branch. The mode in which the branches are given off by exogens gives rise to the different habits of the cedar, the spruce, and the poplar. The nature of a landscape depends much on the mode in which the stems and branches of trees are developed.

The Leaves of Plants.

Leaf-buds are produced on stems and branches at regular intervals. There is a tendency to a spiral arrangement of buds. Leaves are placed alternately on the stem in a certain number of rows, according to the following series of numbers: 1, 2, 3, 5, 8, 13, 21, 34, &c., the sum of two succeeding numbers making up the following one. Thus there is a two-rowed leaf arrangement where the third leaf is situated directly above the first, the fourth above the second, and so on; a three-rowed arrangement, in which the fourth leaf is above the first, and the fifth above the second, and so on; a five-rowed arrangement, in which the sixth is above the first, the seventh above the second, and so on. Sometimes leaves are placed opposite to each other, and apparently at the same level, and in that case the leaves in each set alternate with those in the sets next them. By this law of alternation the leaves are fully exposed to light and air, and a wise provision is made for the production of the rounded stem, and for the elaboration of the fluids which reach the leaves from the roots. The leaves consist of cells and vessels in the same way as the stem. The vessels are seen in the ribs and veins. In some leaves the veins form an angular network, and are said to be reticulated (Fig. 16). Such leaves are usually associated with a dicotyledonous embryo, and exogenous stem. In other instances the veins run parallel, and do not form angular meshes (Fig. 17).

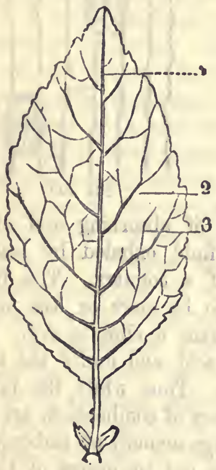


FIG. 16.[1]

FIG. 17.[2]

Such leaves are associated with monocotyledonous and endogenous plants. A third set of leaves have forked veins, and these are usually found in acotyledonous and acrogenous plants.

When a leaf consists of one piece, either undivided or divided, but not jointed to the stalk, it is called simple (Figs. 16 and 17). When it is composed of separate leaflets, which are articulated to

[1] (Fig. 16.) Reticulated simple leaf, showing angular meshes produced by the veins. These veins consist of different kinds of tubes or vessels combined, while the spaces between them consist of cells. The midrib (1) is a continuation of the leaf-stalk. It gives off primary veins (2), and these divide into secondary veins (3).

[2] (Fig. 17.) Simple parallel-veined leaf of a palm. There are no angular meshes in the leaf.

the stalk, it is compound (Fig. 18). Occasionally leaves are folded, and their edges become united so as to form pitcher-like appendages. There are openings in leaves called stomata (Fig. 19). These are opened and closed according to the moist or dry nature of the atmosphere. They exist chiefly on the lower surface of

Fig. 18.[1]

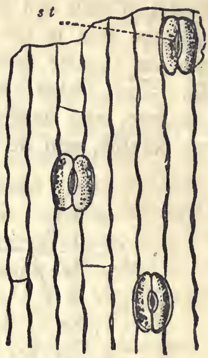


Fig. 19.[2]

leaves. Leaves have the power of absorbing and of exhaling fluids and gases. The watery fluid exhaled by leaves has a marked effect on the climate of a country. The presence of forests thus causes the climate to be more or less moist. The felling of forests occasionally makes a climate dry. Leaves in their green state absorb carbonic acid, and under the influence of light they give out oxygen gas. Thus while the breathing of man and animals, and the processes of combustion, are constantly sending into the atmosphere a large amount of carbonic acid gas, plants are taking up the noxious gas by means of their leaves, applying the carbon to important purposes in their economy, and giving out oxygen gas. How wondrous are the adaptations of different parts of creation to each other! Plants are employed to prepare solid food for man and animals, as well as carbon for combustion, and at the same time to purify the atmosphere which living beings inhale. In the case of aquatic plants, we find that the power of giving out oxygen gas under the influence of the sun

[1] (Fig. 18.) Compound leaf of melilot, consisting of three leaflets which are connected by joints to a common leaf-stalk.

[2] (Fig 19.) Skin of the leaf of a lily, showing stomata *s t*. These consist of two cells surrounding an opening. This opening is closed in dry weather.

is very great. The green herbage floating on a pond has a decided effect on the purity of the water by decomposing noxious gases, and giving out a pure respirable air. If leaves are not exposed to light they lose their green colour, and become blanched. In this condition they give out carbonic acid. The blanching of the green parts of plants by non-exposure to light is resorted to by gardeners for the purpose of procuring tender and delicate vegetables. By this process the plant is prevented from forming woody matter, and delicate cells are alone produced. The blanching of asparagus, celery, sea-kale, and other culinary vegetables are familiar instances of this. By blanching, leaves not only lose their colour, but are also prevented from forming various secretions. A strong-smelling plant may in such circumstances become perfectly inodorous. After performing their functions, leaves fall off and decay. In some cases the leaves remain more or less permanently, and such plants are called evergreen. In our ordinary forest trees the leaves fall off, leaving scars on the stems and branches. Such leaves are called deciduous.

Movements are exhibited by some compound leaves. These movements appear to be connected with changes in the cellular swellings, which occur at the bases of the leaflets and of the leaf-stalks. Light and darkness have a marked influence on such leaves. During the night the leaflets are folded upon each other, so as to exhibit what Linnæus called the *sleep of plants;* while during the day the leaflets spread out and expand. In certain plants the leaf-movements are exhibited also under the influence of mechanical or chemical *stimuli*, as by touch or the contact of fluids or gases of a narcotic or irritant nature. Such plants are called *sensitive*, and may be illustrated by the *Mimosa sensitiva* and *Mimosa pudica.* The moving plant of India (*Desmodium gyrans*) is provided with small leaflets which are constantly jerking from one side to the other. Venus's fly-trap (*Dionæa muscipula*) has hairs on its leaf-blades, which, when touched, cause the leaves to fold. The motion of the sap of plants is influenced by a certain power of imbibition called *osmose*, as well as by the actions going on in the leaves. In ordinary trees, the fluids taken up by the cells of the roots, ascend through the newer woody parts of the stem, reach the leaves, are there exposed to the action of air and light, and finally return by the bark to the lower parts of the stem. This course has been determined by wounding the stem at separate parts during the spring months, as well as by causing the plant to absorb some chemical substance in a diluted state, the presence of which at different heights in the stem can be easily detected by some other chemical re-agent.

Reproductive Organs of Plants.

The reproductive organs of plants consist of the flower and its parts. These generally arise from the point where a leaf, called a floral leaf or bract, comes off from the axis. Bracts may be the ordinary leaves of a plant, as in some of the common speedwells, or they may be coloured and modified leaves of various kinds. The arrangement of the flowers on the common stalk is called the *inflorescence;* and it has been divided into two kinds called de-

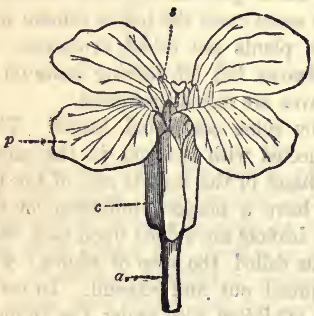


Fig. 20.[1]

Fig. 21.[2]

finite and indefinite. In the former, each floral axis ends in a single flower, and the expansion of the flowers on the different axes takes place from the centre to the circumference, or from above downwards as in gentian and spearwort. In the latter, the floral axis bears a congeries of flowers which expand from the circumference to the centre, or from below upwards, as in the hemlock

[1] (Fig. 20.) Flower of common wallflower. The stalk of the flower is called the peduncle, *a;* the calyx, or first whorl *c,* consists of four leaves called sepals; the corolla, or second whorl *p,* is formed of four coloured leaves called petals; the stamens, or third whorl *s,* are next seen; and in the centre there is the fourth whorl or pistil.

[2] (Fig. 21.) The essential organs of reproduction of the wallflower, with the calyx and corolla removed. The stamens *s,* consist of stalks or filaments bearing anthers which contain pollen; they surround the pistil which is in the centre. The pistil is formed by leaves called carpels, and consists of the ovary, short style, and a stigma at the top *b.* The place into which the parts of the flower are inserted *r,* is called the receptacle. Glands at the base of the stamen are marked *g.*

and hyacinth. The flowering of plants takes place at different periods of the year, and thus a floral calendar has been formed in which each month is characterized by the flowering of certain plants. In addition to this, it is found that the opening of flowers takes place at different times of the day, and thus a sort of floral clock has been constructed in which the hours of the day are indicated by the opening of certain flowers. Some plants open their flowers late at night and are night-flowering. Of this kind is the *Cereus grandiflorus*, which expands its blossoms about ten P.M. in Britain. During flowering some plants develop heat. This depends on a chemical action going on between the oxygen of the air and the carbon of the flower, by which starch is converted into sugar, and carbonic acid is evolved. In the *arums* the production of heat is very marked.

The flower consists usually of four parts: the calyx on the outside, or below the other parts; then the corolla, the stamens, and the pistil (Figs. 20, 21, p. 222). The calyx protects the whole flower; the corolla guards the internal organs, and at the same time secretes a honey-like matter concerned in the nourishment of the plants; while the stamens and pistil are connected essentially with the production of fruit and seed, the latter containing the embryo plant, with its nutriment, and preserving it until it is placed in circumstances suited to its growth. There is an adaptation in all these organs, however minute, which show the overruling providence of God in the construction and preservation of the meanest flower.

Each of the four parts of the flower consists of a set of leaves arranged in a circle or whorl. The leaves composing the different whorls are more or less modified, so as to serve the function which they have to perform. The number of parts in each whorl follows the series two, three, and five, or multiples of these. The number three prevails in the flowers of monocotyledonous plants, as seen in the tulip, hyacinth, and lily; while the numbers two, four, and five, prevail in the flowers of dicotyledonous plants, as in speedwell, willow-herb, and buttercup. The parts in each whorl are arranged alternately with those of the next whorl (Fig. 22).

FIG. 22 [1]

[1] **(Fig. 22.) Diagram of a flower of four whorls, each of which contains five parts. These parts are arranged alternately, the petals alternating with the sepals, the stamens with**

The outer envelopes of the flower are the calyx and corolla. One or both of these may be wanting. When both are present, the flower is said to have two coverings; when only one (the calyx), the flower is said to have one covering; and when both are absent, the flower is said to be naked or to have no covering. The leaves composing these whorls may be separate or united. These characters are taken into account in forming the sub-classes of the natural system of classification.

The stamens and pistil are the essential organs of the flower. They are concerned in the production of seed, and they must be present in order to constitute a flower in a botanical sense. Occasionally the stamens and pistils are in separate flowers, either on the same plant, as in the hazel, or on distinct plants, as in the willow.

The calyx has often a green colour; sometimes it assumes other colours, as in the globe flower and the aconite, in which it is respectively yellow and blue. The calyx is sometimes united to the ovary (Fig. 23). In the dandelion the calyx of each of the flowers becomes hairy, and remains attached to the fruit so as to scatter it.

The corolla is usually beautifully coloured, the colours being white, red, yellow, and blue. In the corolla reside commonly the odours of flowers.

A stamen consists generally of two parts (Fig. 21, p. 222), a stalk or filament, and an anther or bag containing powdery matter called pollen, which is often yellow. The number of the stamens was taken into account by Linnæus in the formation of some of the classes of his system. Stamens are sometimes united together either by the stalks or by the anthers.

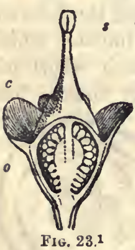


Fig. 23.[1]

The pistil consists of modified leaves called carpels, either separate as in the buttercup, columbine, and stonecrop, or united as in the poppy, the chickweed, and the lily. Sometimes one carpel constitutes the pistil, as in the pea. In the double-flowering cherry, the pistil appears as one or two folded leaves, and it does not produce fruit. The parts of a pistil are the ovary *o*, (Fig. 23), containing the ovules or young seeds, and the stigma *s*, which

the petals, and the carpels with the stamens. This is the normal or regular position of the parts.

[1] (Fig. 23.) Pistil of a saxifrage with the calyx *c* partially attached to it. The ovary *o* is cut open vertically to show the ovules or young seeds. Above, is the style *t*, terminated by the stigma *s*.

is either placed on the top of the ovary directly, or separated from it by a stalk called the style *t*. The number of pistils was employed by Linnæus to characterize some of the orders in his system.

The essential organs of the flower are concerned in the production of fruit and seed. The anthers burst in various ways by slits or openings, in order to scatter the pollen which is thus applied to the stigma. There it is retained by means of a viscid secretion, and each of the grains sends out a small tube which descends to the ovule in the ovary. After this the little embryo plant begins to be developed in the ovule. Subsequent to this the fruit is formed, containing the mature seed with the embryo plant inside. Provision is made for the application of the pollen to the stigma. The anthers often burst in an elastic manner, so as to scatter the pollen. The stalks or filaments of the nettle and pellitory are curved inwards, and retained in their place by the covering of the flowers, and when the latter expands they start up in an elastic manner, and disperse the pollen. In the case of the hazel, the flowers containing stamens, and those containing pistils, are separate, and they are produced in spring before the leaves expand; in this way the broad leaves are not allowed to interfere with the application of the pollen. Insects are often employed to scatter the pollen; while insinuating themselves into flowers and collecting honey, they at the same time aid the essential organs in their functions.

The Fruit and Seed.

The fruit is the mature pistil containing the seeds. To the fruit the calyx sometimes remains attached (Fig. 23, *c*), as in the gooseberry and apple. Some fruits are formed by the pistil of one flower, and are called simple, as the strawberry and raspberry; others are formed by the pistils of several flowers, and are called multiple, as the mulberry and pine-apple, cone, fig, and bread-fruit.

When mature, the fruit either bursts to scatter the seed, as in the pea, broom, campion, and iris, or it falls with the seeds in its interior, as the gooseberry, apple, cherry, and peach.

The varieties of cultivated fruit are produced by the art of horticulture, and they are kept up by the process of grafting. When a particular kind of fruit, as the apple or pear, has been improved by high cultivation, slips are taken from the plant, and grafted on well-grown stocks, and thus prized varieties are produced and kept up. All the fine kinds of apples have arisen from one parent kind, viz., the crab-apple. They can only be produced by cultivation in good soil and by grafting. The seeds of the finest varieties of these fruits, if sown in ordinary poor soil, would revert to the original crab.

A perfect seed contains the embryo plant. Seeds are sometimes provided with hairs, as in the cotton plant, or wing-like appendages, as in the fir, by means of which they are wafted to a distance. When they reach the soil, and are exposed to moisture and heat, they begin to sprout. We have already given an account of the mode in which the young plant goes through its different phases of germination. In the case of cultivated plants, such as corn, it is of importance that moisture, heat, and air, should be supplied in proper quantity to the plants. Hence the necessity for draining, so as to allow superfluous moisture to be carried off, and the soil to be heated and aërated; well-drained soil is much warmer than water-logged soil.

When a seed germinates or sprouts, chemical changes take place in it, by means of which the starch is converted into sugar, carbonic acid is evolved, and heat is produced. These changes are well seen in the malting of barley; the embryo contained in the grains begins to send out its little roots, heat is developed, and the starchy matter of the grain is changed into sugar. When this change takes place, the process is arrested by drying the grain, and thus the sugar can be used by man for fermentation.

FIG. 24.[1]

In ferns, and the lower classes of plants, in place of seeds, minute cells called spores (Fig. 5, p. 212) are formed which serve the purpose of seeds. Ferns have no flowers. They produce leafy fronds which bear cases or bags, in the interior of which the spores are formed (Fig. 24). The brown dust of ferns consists of these spores. The cases often burst by means of an elastic ring surrounding them (Fig. 24 *a*).

[1] (Fig. 24.) Spore-case of a fern, supported on a stalk *p*, and surrounded by a ring *a*, which by its elasticity causes the case to open, and scatter the spores or germs.

PRACTICAL LESSONS.

ILLUSTRATIONS TAKEN FROM COMMON WEEDS.

Dicotyledonous Plants.—(*Exogenous and Phanerogamous.*)

1. The Butter-cup.—As an illustration of an exogenous dicotyledonous plant, take the common buttercup of the fields. Dig up the plant, and you will find the roots consisting of a number of tapering divisions which end in little fibrils bearing the absorbing points called spongioles. The leaves are of a green colour, and much divided; some of them are near the root, others are further up the stem, the latter having their divisions narrower than the former. Small leaflets are placed on the flower stalk below the flower; these are bracts. We next come to the flower with its four whorls, calyx, corolla, stamens, and pistil. These whorls are usually arranged in fives or multiples of five. The outer row consists of the greenish-yellow sepals, which alternate with the second row of yellow petals, bearing at their base little depressions covered with scales and secreting a honey-like fluid. Proceeding inwards, we have next the yellow stamens in several rows, with their stalks or filaments supporting the anthers in which the pollen is contained. In the centre of the flower is the green pistil, consisting of numerous small folded leaves called carpels. Each carpel consists of an ovary, style, and stigma, and in the interior of the ovary there is a single ovule. These ovules ultimately become seeds, having the little embryo plant in their interior along with a quantity of nourishing matter; what are commonly called butter-cup seeds are in reality single-seeded fruits.

2. Heart's-ease.—The common heart's-ease will form a useful subject of study. Its leaves are of a somewhat oval or egg-like shape, the broadest part of the leaf being next the stem. At the base of the leaves there are remarkably divided leaflets called stipules; these give a peculiar character to the plant. The calyx consists of five green leaves attached to the receptacle a little above their base, so that the base is extended. The corolla is irregular, its five parts being of different sizes; one of them has a long spur. The stamens are five in number, united by their yellow anthers, which have orange-coloured appendages at their summits. Two of the anthers send small processes or spurs into the hollow spur

of the petal. The pistil in the centre exhibits an ovary, surmounted by a slightly curved style, and a curious hooded stigma with a hole on one side. When the fruit is ripe, it opens into three parts or valves, in the centre of each of which is a partition to which the seeds are attached. The calyx remains with the fruit, after the petals and stamens have fallen.

3. Shepherd's Purse.—In the common shepherd's purse which occurs on every road-side, observe the lower leaves divided laterally, the stem-leaves more or less shaped like an arrow where they join the stalk, the flowers on short stalks coming off from a common axis and expanding from below upwards (*i.e.* the lowest opening first), the flowers consisting of four calycine leaves alternating with four white petals arranged like a cross (hence called cruciform or cross-bearing); the stamens, six in number, of which four are longer than the two others (a very important character in cruciform plants, Fig. 21, p. 222); the pistil, consisting of a green, wedge-shaped body, which, as it enlarges and becomes the fruit, assumes a purse-like shape (hence the name of the plant); the pod which forms the fruit opening by two boat-shaped pieces or valves, and leaving in the centre a thin partition, to the edges of which the seeds are attached.

4. The Pea.—Again, we may take a common pea, and notice its compound leaves with two leaflets at their base, called stipules; then the five-lobed calyx, and the five parts of the corolla—the large one, which is folded over the others in the bud, being the standard, the two side ones the wings, and the lower one formed of two which united form the keel. Within this keel are concealed the essential organs of reproduction—the stamens and pistil. The stamens are ten in number, either united into one complete tube by their filaments, or nine of them are thus united, and one is separate. The pistil is the young pod, consisting of ovary, style, and stigma. The pod when ripe is called a legume, and it opens on each side, so as to scatter the seeds which are attached along one side, viz., that next the axis. The name given to the pod is the origin of that applied to the pea family, viz., Leguminous.

5. The Dandelion.—Next take the common dandelion as an object of study. In it we have a tapering root yielding a milky

juice, which is used medicinally. The leaves arise from a short stem, forming the crown of the root. These leaves have a peculiar form called runcinate, from their resemblance to a coarse saw, with the marginal divisions pointing downwards towards the root. From the centre of the leaves arises usually one hollow delicate stalk, which ends in a yellow head. This head is not a single flower, like the butter-cup, but a congeries of little perfect flowers of a peculiar form called ligulate or strap-like. Surrounding the flowers is a set of small green leaves called bracts, or flower-leaves.

Next examine the flowers. They are placed on the round expanded summit of the stalk, or on what is called the receptacle. The yellow flowers have at the base a small single-seeded fruit, surmounted by a hairy ring, which is in reality the upper part of the calyx, the lower part being closely united to the fruit. Within this is the corolla, consisting of five united petals, which are split in such a way as to spread out in a strap-like form on one side. Next the row of five stamens is seen, with their anthers united into a tube round the style. In the centre is the pistil, consisting of an ovary below, with a single ovule, then a style, and a two-cleft stigma. The ovary and ovule, when mature, form the fruit and seed, the former being incorporated with the lower part of the calyx. The hairy, or as it is called pappose, upper part of the calyx elongates into a stalk, having the hairs expanded at its extremity, and when the fruit is fully ripe, the various hairy calyces form a globular head.

The receptacle into which the flowers are inserted is at first succulent, and contains a milky juice for the nourishment of the flowers, but it finally becomes dry, and assumes a convex form on the top, while at the same time the bracts are turned downwards. Thus it is that a beautiful provision is made for the scattering of the fruit by the agency of the wind. When mature, the slightest breeze carries off the hairy fruit, which is wafted by its calycine parachutes to a distance, and deposited in a soil fit for its germination. The fruit and seeds of thistles are dispersed in a similar way, and hence the noxious quality of these weeds, which since the curse pronounced on the earth have been brought forth abundantly.

6. The Daisy.—The daisy supplies an illustration of a flower belonging to the same order as the dandelion. In it we want the

marked pappose calyx, but we have a receptacle at the end of the stalk, bearing a number of white, strap-shaped flowers at the margin, each enclosing a pistil, and no stamens, and in the centre regular yellow flowers, each having stamens and pistil,—the pollen from the stamens of the central flowers fertilizing the ovules of the marginal flowers. The receptacle of the daisy becomes ultimately dry and of a conical shape, and thus scatters the fruit. The last two plants having numerous flowers on a common head, and with their anthers united, are called composite, and they constitute a large proportion of the plants of the globe. Besides the weeds noticed, we have familiar instances in the groundsel, the ragwort, the hawk-weed, the burdock, the sow-thistle, the colt's-foot, and the asters.

Monocotyledonous Plants.—(*Endogenous and Phanerogamous.*)

1. Tulip.—To illustrate the monocotyledonous plants, gather a tulip and examine its various parts. First there is underground a thickened bulb-like body, with thinnish brown scales outside, and a solid mass within. This is an underground stem or corm. It produces lateral buds by which the plant is propagated. The corm gives off roots from its lower surface, and a leaf-bud from its upper part ; this bud expands into the parallel-veined leaves. In the centre is produced the flower supported on a long stalk. The parts of the envelope are all alike coloured ; these are six, viz. three external, representing a calyx, and three internal alternating, representing a corolla. Next there are six stamens, with anthers containing pollen, and filaments ; and finally, a pistil, consisting of an ovary containing ovules, and a three-lobed stigma at the top of it. The fruit consists of three parts, as may be seen by cutting the mature ovary transversely. In this instance, the envelopes and stamens are evidently placed below the pistil, and are said to be inferior, *i.e.*, below the ovary. This is an important distinguishing character.

7. Daffodil.—As another example of a monocotyledonous plant we may take the common narcissus or daffodil, so abundant in our gardens in spring and early summer. Here there is a bulb or underground stem, bearing scales and a bud above, and roots below. Such bulbs and underground stems are common among monocotyledons. From this bulb arise the long, narrow, parallel-veined leaves, which contain much viscid matter in their cells, and

abound in spirals, easily seen on rupturing the leaf. The flowering stalk rises from the centre, and bears a single flower at its apex. This flower shows the arrangement according to the number three, or the ternary symmetry. The yellow floral envelope shows six divisions, three exterior, three interior; and besides, there is a peculiar cup-like ring in the centre which is an extra appendage to the flower, and is called a crown. The stamens are six, thus also a multiple of three. The pistil consists of its three parts, the ovary which is united with the floral envelope, and is seen in the form of a rounded greenish swelling below the flower, the style and stigma seen inside the flower. The fruit consists of three parts, enclosing the seeds, as may be seen by cutting the mature ovary across. In this plant the envelopes and stamens appear above the ovary, and are called superior. This is an important distinguishing character.

Acotyledonous Plants.—(*Acrogenous and Cryptogamous.*)

1. FERN.—As illustrations of acotyledonous plants we may take a fern and a moss. The common male fern shows the acrogenous stem made up of the bases of the leaves united. The leaves or fronds when young are rolled up like a crozier, and are covered with scales or chaff. The leaves or fronds are divided like compound leaves, and have on their back minute rounded clusters of fructification with a thin covering. These clusters consist of numerous little cases or bags partly surrounded by elastic rings, by means of which the sacs split transversely, so as to scatter the germs or spores, which are commonly called the dust of the fern. (Fig. 24, p. 226.)

2. MOSS.—A common moss is apt to be neglected and overlooked; but examine it and you see beautiful cellular leaves, a stalk bearing a brown urn-like case, covered often with a thin hood which falls off; at the upper part of the urn-case is a lid which usually falls off, in order to allow the germs to be scattered. After the lid is removed, there is seen round the upper part or mouth of the sac, a beautiful fringe consisting of cellular processes, which are arranged in fours, or in multiples of four, as 8, 12, 16, 32, &c. The beautiful structure of a moss, as well as of other cryptogamic plants, which require the aid of the microscope for their examination, is well fitted to call forth our wonder and our

admiration of the works of that Being who, while he weighs the hills in scales and the mountains in a balance, despises not the minutest organism in creation.

CLASSIFICATION OR ARRANGEMENT OF PLANTS.*

When we examine the vegetable kingdom we find throughout the whole of it not only a beautiful principle of adaptation, indicating the work and superintendence of a designing mind; but also a system of order and arrangement, both as regards the parts of which plants are composed, and the relation which the members of the vegetable kingdom bear to each other. We see around us various kinds of plants which more or less resemble each other, or, in other words, which are more or less related to each other. In botanical classification we endeavour to mark these resemblances, to determine their relation, and to trace out the plan on which they have been arranged by the great Author of Nature. We must aid the student of botany in his researches by adopting some classification of the 120,000 known species of plants on the earth. Two systems of classification have been adopted. One of them is called artificial, because it selects arbitrarily only one or two characters, and endeavours to group all plants according to them. The other is called natural, because it attempts to group plants by means of all their important characters, and takes into account their affinity and relation in all essential points. To the former is referred the system of Linnæus, which divides plants into classes and orders by means of the stamens and pistils. Such a system does sometimes bring together plants which are evidently nearly allied, but it often separates them. It resembles an alphabetical index, where all that requires to be known is the succession of the letters of the alphabet, and where subjects are placed together which are often totally distinct.

The natural method, on the other hand, brings in the idea of affinity or alliance in all important characters, and it professes to group together plants which are truly related in essential parts. It is like a well-arranged analytical table of contents, in which allied subjects are brought together, and the whole is arranged so as to give a complete idea of the plan in the mind of the author.

* The lesson under this head is chiefly taken from Professor Balfour's work on *Religion and Botany*. A. & C Black, Edinburgh, 1859.

So the natural system in botany proposes to arrange plants in such a way as to give an idea of the plan of creation. Plants as they occur in nature are viewed as individuals resembling or differing from each other. Some individuals are so decidedly alike that we at once give them the same names. Thus a field of wheat is composed of numerous similar individuals which can be separated from each other, but cannot be distinguished by any permanent or marked difference. Although there may be some difference as regards size and other minor points, still we at once say that they are all stalks of wheat. Every grain of wheat when sown, produces a stalk of wheat, and these stalks yield grains which produce individuals like their parents. The shoots or buds given off from the base of wheat by tillering, also produce stalks of wheat. From considerations such as these, we derive our idea of what is called a *species*, which may be defined as an assemblage of individuals presenting certain characters in common, and derived from one original stock.

There are no doubt differences in the individuals of a species, depending on soil and on different conditions of heat, light, and moisture. But these differences are not incompatible with the idea of a common origin ; and moreover we find that there is always a tendency to return to the original type. What is called a *variety*, is an individual of a species exhibiting variations which are not in general of a permanent character, and which cannot be kept up in the natural state, or, in ordinary circumstances, by seed. By means of buds or slips such varieties may be continued, but if their seeds are sown in ordinary soil and left to grow wild, the plants tend to return to the specific type. In certain plants, such as cereal crops and culinary vegetables, varieties have been perpetuated from seed by the art of cultivation, and thus races are kept up by artificial means. But when the seeds of such plants are sown in ordinary circumstances, and the plants are allowed to grow wild, we then see that there is a return to the parent type. In illustration of this statement we may refer to ordinary vegetables, such as cabbage, cauliflower, brocoli, savoys, and curled greens, which are all derived from one stock or type (*Brassica oleracea*). This plant grows wild on our sea-shores in certain places, and when cultivated it assumes peculiar forms. Thus it forms a heart, as in ordinary cabbage ; its flower-stalks become thickened and shortened, as in cauliflower and brocoli ; or its cellular tissue is largely developed, so as to give rise to the curled appearance of greens. These varieties are continued by cultivation, and after a series of generations, the seeds of the varieties propagate, more or less completely, plants of a similar nature. But if they are allowed to grow wild, then in the progress of time the variations disappear, and the original type of the species is reverted to. The varieties of apples and pears are continued by the art of horticulture and the process of grafting, but the seeds of these plants, when allowed to grow wild, produce the original stock, viz., the crab-apple or crab-pear, whence all the varieties have been produced. All these facts show the permanence of species in nature, and are not in accordance with the ideas of those naturalists, who state that one species can be transmuted into another in the course of generations.

Having thus determined what species are, we proceed to group them together so as to form a *genus*. This is an assemblage of nearly related species, agreeing with one another in general structure and appearance more closely than they accord with other species. Thus the genus Rosa or rose includes plants which are obviously allied as regards their general character, their flower, and their fruit. All of them have a well-marked kind of fruit, as seen in the common hep. But under this genus there are numerous species, such as the Scotch Rose, the Dog Rose, the Sweet-briar, and the China Rose, which differ in minor characters, derived from their leaves and other organs. The genus Quercus or oak includes many species which differ in the form of their leaves and in other respects, but all agree in their catkins, and in the character of their fruit, called an acorn.

Again, in examining genera, it will be seen that some of them, such as oaks, hazels, beeches, and chestnuts, have a strong resemblance or family-likeness, more especially as bearing catkins, or being what is called amentiferous, and that they differ remarkably from such genera as firs and pines, which bear cones, and from maples, which bear a winged fruit called a samara. In this way we group genera so as to form what are called *orders* or *families*. While a genus then is a group of allied species, an order is a group of allied genera. Thus firs, spruces, pines, larches, cedars, are united together in an order denominated Coniferæ or cone-bearers; while genera having a fruit called a legume are associated under the order Leguminosæ. Sub-orders, or subdivisions of an order, may be formed also so as to group genera belonging evidently to the same order, but having special points of alliance, and thus facilities may be afforded to the student of botany in his determination of species. Certain orders again are more nearly allied than others, and thus we can group them into still larger assemblages called *classes*. Subdivisions of classes, called sub-classes, are also formed to facilitate reference. The great object is to bring together those plants which are allied to each other in the structure of all their important organs.

We thus arrive at the following divisions :—

I. Class. Sub-class.	III. Genus. Sub-genus.
II. Order or Family. Sub-order.	IV. Species. Variety.

In giving the name of a plant we express the genus and the species. Thus *Rosa spinosissima* is the Scotch rose, where *Rosa* is the generic name and *spinosissima* the specific or trivial name ; so also *Rosa canina*, the dog rose ; *Rosa rubiginosa*, the sweet-briar. In giving the characters of classes, orders, genera, and species, we enumerate those marks which are necessary to distinguish them from others in the same category. These are called essential characters, and the shorter they can be made the better. Classes are distinguished by important general points of structure, such as the presence or absence of cotyledons, and their number. Orders are distinguished by characters taken from the general structure of the flowers and fruit. In the generic character we notice the modification of the ordinal characters in a given genus ; while in the specific characters are included less important modifications of form, whether in the stem, leaves, or flowers, which serve to distinguish allied species.

The object of this scientific classification is to bring together plants which are allied in all essential points of structure, and thus to follow what may be supposed to be the system of nature or the plan of the Great Creator. To accomplish this requires a full knowledge of the structure of plants all over the world ; and hence the systems adopted cannot, in the present state of our knowledge of the flora of the globe, be looked upon as by any means complete. Moreover we shall find that our divisions will prove, in many cases, more or less temporary or artificial, because in nature there are seldom marked and evident boundaries between groups. One class or order seems to pass into another by insensible gradations. There are no abrupt transitions to suit our precise modes of defining groups. Hence, while we can point out great centres of classification, as it were, round which we can arrange the plants of the globe, we are constrained to admit the incompleteness of all our definitions and lines of demarcation. We meet with aberrant forms which will not suit themselves to our definite groups, and which in fact possess, in a certain degree, characters common to several. Such forms, however, are useful landmarks, and they assist us in seeing the alliances subsisting between different orders. They point out in a very instructive manner the Master Builder's plan; and although they may puzzle the student who adheres rigidly to definitions given in books, they give to the advanced student of nature enlarged and instructive views of affinities, and lead him to take a comprehensive survey of the plan of creation. On such ideas of affinity and relationship the natural system of botany has been founded by such men as Ray, Jussieu, De Candolle, Brown, Endlicher, Lindley, and Hooker.

Let us endeavour now to give a view of the natural system. In doing this we must take into account the structure and conformation of all parts of plants:—

Beginning with the elementary tissues, it will be observed that some plants have cellular tissue (Fig. 10, p. 216) only in their composition, others have vessels of various kinds (Figs. 11 and 12). Thus we have two natural divisions of cellular and vascular plants. The latter may again be subdivided into those having true unrollable spiral vessels, and those having only modifications of such vessels in the form of scalariform vascular tissue. Cellular plants are represented by sea-weeds, mushrooms, and lichens; vascular plants with scalariform vessels by ferns; and vascular plants with spiral vessels by ordinary trees, shrubs, and herbs.

If we now take the nutritive organs, we shall arrive also at marked divisions. The embryo plant may be cellular without cotyledons, or it may have one or two cotyledons. By this means we get the great primary divisions of acotyledonous plants (Fig. 8, p. 213), such as sea-weeds, ferns, &c.; monocotyledonous plants (Fig. 7), as palms, lilies, and grasses; and dicotyledonous plants (Fig. 6), as peas, beans, and the trees and shrubs of Britain.

Next take stems, and we have plants having cellular or thallogenous stems, others acrogenous, a third set endogenous, and a fourth exogenous (Figs. 13, 14, 15, pp. 216, 217). Leaves furnish the division into plants which are veinless, those having forked veins of the leaf, those having parallel venation, and those having reticulated venation (Figs. 16 and 17).

In the next place, consider the organs of reproduction; and here we meet with flowering plants having proper flowers, and flowerless plants having no such organs. In flowering plants, the parts of the flower are arranged in threes in one great division, and in two, four, and five in another (Fig. 22, p. 223). Stamens, and pistils with their seeds, occur in flowering plants; cells of a peculiar nature supply the place of these evident organs in flowerless plants. On carefully examining these characters, we shall find that we can form the following divisions, and thus constitute the basis of a natural classification :—

Cellular Plants without Vessels.	Vascular Plants with Scalariform Vessels.	Vascular Plants with Spiral Vessels.	
Acotyledons.	Acotyledons.	Monocotyledons.	Dicotyledons.
Thallogens.	Acrogens.	Endogens.	Exogens.
Veinless.	Forked veins.	Parallel Veins.	Reticulated Veins.
Flowerless.	Flowerless.	Flowering; flowers with 3-fold Symmetry.	Flowering; flowers with 2-fold or 5-fold Symmetry.
Cellular Organs of Reproduction and Spores.	Cellular Organs of Reproduction and Spores.	Stamens and Pistils, and Seeds.	Stamens and Pistils, and Seeds.

Adopting these general principles of structure and arrangement, and, moreover, taking into account the relative position of different organs, their separation or adhesion, their completeness or incompleteness, we are enabled to construct a plan of classification which has been denominated a Natural System. The following are the outlines of this plan :—

A. PHANEROGAMOUS OR FLOWERING PLANTS, WITH COTYLEDONS, STAMENS AND PISTILS, AND SEEDS.

CLASS I. DICOTYLEDONES or EXOGENÆ, in which spiral vessels are present; the stem is exogenous; venation of leaves reticulated; flowers with binary or quinary symmetry; embryo dicotyledonous.

Sub-class I. THALAMIFLORÆ.—Flowers usually with calyx and corolla, petals separate, inserted on the thalamus or receptacle, and stamens hypogynous (below ovary), as in Fig. 21, p. 222. *Example*—buttercup and wallflower.

Sub-class II. CALYCIFLORÆ.—Flowers usually with calyx and corolla, petals either separate or united, stamens either perigynous (around ovary), or epigynous (above ovary), as in Fig. 23, p. 224.

Section 1. *Polypetalæ.*—Petals separate. *Example*—wild rose, strawberry, and hemlock.

Section 2. *Monopetalæ* or *Gamopetalæ.*—Petals united. *Example*—harebell and dandelion.

Sub-class III. COROLLIFLORÆ.—Flowers usually having calyx and corolla, petals united, corolla hypogynous (below ovary). *Example*—foxglove and primrose.

Sub-class IV. MONOCHLAMYDEÆ or APETALÆ.—Flowers either with calyx only, or without any envelope.

Section 1. *Angiospermæ.*—Seeds contained in a seed-vessel, and ovules fertilized by the action of the pollen on the stigma. *Example*—pellitory and willow.

Section 2. *Gymnospermæ.*—Seeds naked, and ovules fertilized by direct action of the pollen upon them, without the intervention of a stigma. *Example*—fir and juniper.

CLASS II.—MONOCOTYLEDONES or ENDOGENÆ, in which spiral vessels are present; the stem is endogenous; venation of leaves parallel; flowers with ternary symmetry; embryo monocotyledonous.

Sub-class I. PETALOIDEÆ.—Flowers consisting of a coloured perianth (calyx and corolla) or of whorled scales.

Section 1. *Epigynæ.*—Perianth adherent and ovary inferior. *Example*—narcissus and snowdrop.

Section 2. *Hypogynæ.*—Perianth free, and ovary superior. *Example*—tulip and lily.

Sub-class II. GLUMIFERÆ.—Flowers consisting of imbricated (overlying like tiles on a house) glumes or bracts. *Ex.*—grasses.

B. Cryptogamous or Flowerless Plants, without Cotyledons, and with no true Stamens nor Pistils.

Class III. ACOTYLEDONES, plants either cellular or having scalariform vessels (tubes marked with lines or bars so as to be like steps of a ladder); stem when woody is acrogenous; leaves veinless or with forked venation; reproductive organs peculiar cellular bodies or spores; no cotyledons.

Sub-class I. Acrogenæ.—Having a distinct leafy stem, with scalariform vessels. *Example*—ferns and mosses.

Sub-class II. Thallogenæ.—Having no distinct stem nor leaves, but forming a cellular expansion or thallus without vessels. *Example*—lichens and seaweeds.

Under these classes and sub-classes are included numerous orders, the names of which are usually derived from some typical genus.

The more deeply we study the structure of plants, and the more diligently we compare those belonging to different countries, the more likely are we to arrive at correct views relative to vegetable groups. Great advances have been made in arrangement, but we cannot say that botanists have yet agreed as to the true system of nature. In attempting to ascertain it we must take a comprehensive view of all the plants of the world, and we must know accurately the structure of their organs in all its diversity. The highest powers of mind may thus be engaged in tracing out the handiwork of Him who is wonderful in counsel and excellent in working. Methodical arrangement is conspicuous in God's works. He is a God of order. His plan is perfect, although we may not have attained to the knowledge of it. The discoveries of science are daily adding new means for the attainment of this knowledge, and we may hope for the final development of the plan of the almighty Architect.

DISTRIBUTION OF PLANTS.

Wherever circumstances are compatible with vegetable existence, there we find plants arise. The solitary island in the midst of the ocean, as well as the extended continent; the parched desert, and the fertile plain; the deep cavern, and the lofty mountain; the stagnant pool, and the meandering stream, have each their peculiar vegetation. Even the sides of the volcano are covered with flowers; and the geysers of Iceland, and the hot springs of Switzerland and Arabia, are not without their vegetable productions. The ever-sounding and mysterious deep hides in its bosom many a plant no less conspicuous for beauty and variety of form than splendour of colour, and admirably fitted for the place it is designed to occupy. On the sands of the torrid zone, the eye of the traveller is occasionally refreshed by the appearance of a few succulent plants which are enabled to thrive amidst these arid regions; and in the realms of perpetual snow which surround the poles, attention is arrested by the prospect of fields of red snow, which owe their existence in part to plants of a microscopic nature (*Protococcus nivalis*). Thus it is that vegetation is spread over all quarters of the globe, and is wisely adapted to all varieties of climate.

"The carpet of flowers and of verdure," Humboldt remarks, "spread over the naked crust of our planet, is unequally woven; it is thicker where the sun rises high in the ever-cloudless heavens, and thinner towards the poles—in the less happy climes where returning frosts often destroy the opening buds of spring, or the ripening fruits of autumn. Everywhere, however, man finds some plants to minister to his support and enjoyment." "Those who view nature with a comprehensive glance," he continues, "see, from the poles to the equator, organic life and vigour gradually augment with the augmentation of vivifying heat. But in the course of this progressive increase, there are reserved to each zone its own peculiar beauties: to the tropics, variety and grandeur of vegetable forms; to the north, the aspect of its meadows and green pastures, and the periodic awakening of nature at the first breath of the mild air of spring. Each zone, besides its own peculiar advantages, has its own distinctive character—each region of the earth has a natural physiognomy peculiar to itself. The idea indicated by the painter, by expressions such as *Swiss nature*, *Italian sky*, &c., rests on a partial perception of this local character in the aspect of nature. The azure of the sky, the lights and shadows, the haze resting in the distance, the form of animals, the succulency of the plants and herbage, the brightness of the foliage, the outline of the mountains, are all elements which determine the total impression characteristic of each district or region."

Dr. W. H. Campbell, in giving an account of the vegetation of the forests of Demerara, writes :—" The luxuriance of the vegetation surpassed everything you could conceive. Every inch of ground was occupied, and the eye looked in vain for any spot which nature had left unclothed and less bountifully supplied than that immediately around you. Indeed, it seemed as if there was one dire scramble for existence, and that each was striving with might and main to reach the upper light and air, lest being left behind in the race, the forfeiture of life should be the penalty."

As we proceed from warm regions towards the poles, we find that as the light and heat diminish, vegetation is checked in the same proportion. At every step of our progress we change the vegetable group. From the hottest climates we pass in succession through those of the pine-apple, sugar-cane, coffee, date, cotton, citron, and olive, till we reach the region of the vine. The spices and fruits of equatorial Asia are succeeded, in the thickets to the east of the Caspian, by the apricot, the peach, and the walnut. In the southern regions of Europe, the dwarf palm, the cypress, and the cork tree make their appearance; the orange and lemon perfume the air with their blossoms, and the myrtle and pomegranate grow wild among the rocks. Again, when we pass the Alps, we find the vegetation of northern climates; forests of oak, beech, and elm adorn the landscape, and are ultimately replaced by various species of hazel, fir, and birch.

The vegetation of cold regions does not assume any of the grandeur and luxuriance which we observe in the tropics. As we approach the shores of the arctic ocean, the trees become few and diminutive. In Siberia, their thin and distorted trunks are clad, as it were, with a fur-like covering of lichens, which occupy the place of the orchids of warm regions. Farther north, the only shrub we find is the dwarf birch; and a little beyond the 70th degree not a tree or shrub is to be seen. Spitzbergen is said to produce only one plant possessed of a proper woody stem; mosses form more than a quarter of the whole vegetation of Melville Island, and the soil of New South Shetland is covered with specks of mosses struggling for existence. Dr. Hooker states that on one of the antarctic islands he gathered the *ghosts* of eighteen cryptogamic plants, chiefly mosses and lichens; and that there appeared no trace whatever of flowering plants. Even in those regions where snow lies upon the ground during the greater part of the year, the Creator calls into existence peculiar tribes of plants, which are enabled, during the short summer of such inhospitable climes, to pass through their various periods of sprouting, flowering, and fruiting. The plants, so to speak, seem to fear lest they should not be able to perfect their seeds before the cold and darkness arrest their growth.

The adaptation of plants to different climates is a subject well fitted to call forth our admiration. The succulent plant, well provided with stores of fluid, and in which evaporation takes place with the greatest difficulty, is made to grow in the parched and thirsty district. In the deserts of the East, and the sandy plains of Arabia, where the heat from the earth dissipates the passing cloud, which hastens, as it were, to shed its refreshing moisture on a more grateful spot, where no water issues from a spring or falls from on high, there the water-melon grows, offering a delicious draught to the traveller. On the pampas of South America, the Cactus, with its juicy stems, like a vegetable fountain, refreshes the wild herds which roam over the plains, and which instinctively tear off the formidable external prickles of the plant in order that they may reach the succulent interior. The Ravenala, or traveller's tree, furnishes from the base of its leaves a supply of water to the traveller in Madagascar. The palm develops its umbrageous foliage in those regions where it is most required for shelter from the heat of the sun. The bread-fruit, banana, plantain, mango, and coco-nut, are produced in abundance in those climates where they are best fitted for the support and wellbeing of the inhabitants. In temperate climes, where animal food is more essential to existence, we meet with the grassy herbage and the green pastures adapted for the food of cattle; while in arctic regions, the lichen on which the rein-deer feeds, thrives at a temperature sufficient to kill most other plants.

J. H. BALFOUR.

SELECT LITERARY EXTRACTS FROM PROSE AUTHORS.

SELECT LITERARY EXTRACTS FROM PROSE AUTHORS.

The Universe.—(Addison.)

To us who dwell on its surface, the earth is by far the most extensive orb that our eyes can anywhere behold; but, to a spectator placed on one of the planets, it looks no larger than a spot. To beings who dwell at still greater distances, it entirely disappears. That which we call alternately the morning and the evening star, as in the one part of the orbit she rides foremost in the procession of night, in the other ushers in and anticipates the dawn, is a planetary world, which, with the five others that so wonderfully vary their mystic dance, are in themselves dark bodies, and shine only by reflection; have fields, and seas, and skies of their own; are furnished with all accommodations for animal subsistence, and are supposed to be the abodes of intellectual life. All these, together with our earthly habitation, are dependent on the sun, receive their light from his rays, and derive their comfort from his benign agency. The sun, which seems to us to perform its daily stages through the sky, is, in this respect, fixed and immovable; it is the great axle about which the globe we inhabit, and other more spacious orbs, wheel their stated courses. The sun, though apparently smaller than the dial it illuminates, is immensely larger than this whole earth, on which so many lofty mountains rise, and such vast oceans roll. A line extending from side to side through the centre of that resplendent orb, would measure more than 882,000 miles: a girdle formed to go round its circumference would require a length of millions. Are we startled at these reports of philosophers? Are we ready to cry out in a transport of surprise, "How mighty is the Being who kindled such a prodigious fire, and keeps alive from age to age such an enormous mass of flame!" Let us attend our philosophic guides, and we shall be brought acquainted with speculations more enlarged and more inflaming. The sun, with all its attendant planets, is but a very little part of the grand machine of the universe; every star, though in appearance no bigger than the diamond that glitters upon a lady's ring, is really a vast globe like the sun in size and in glory; no less spacious, no less luminous, than the radiant source of the day: so that every star is not barely a world, but the centre of a magnificent system; has a retinue of worlds irradiated by its beams, and revolving round its attractive influence—all which are lost to our sight. That the stars appear like so many diminutive points, is owing to their immense and inconceivable distance. So immense and inconceivable is the distance, that we could hardly express it in figures.

While beholding this vast expanse I learn my own extreme meanness, I would also discover the abject littleness of all terrestrial things. What is the earth, with all her ostentatious scenes, compared with this astonishingly grand furniture of the skies? What, but a dim speck hardly perceptible in the map of the universe? It is observed by a very judicious writer, that if the sun himself, which enlightens this part of the creation, were extinguished, and all the host of planetary worlds which move about him were annihilated, they would not be missed by an eye that can take in the whole compass of nature any more than a grain of sand upon the sea-shore. The bulk of which they consist, and the space which they occupy, are so exceedingly little in comparison of the whole, that their loss would leave scarce a blank in the immensity of God's works. If, then, not our globe only, but this whole system, be so very diminutive, what is a kingdom or a country? What are a few lordships, or the so much-admired patrimonies of those who are styled wealthy? When I measure them with my own little pittance, they swell into proud and bloated dimensions; but when I take the universe for my standard, how scanty is their size, how contemptible their figure; they shrink into pompous nothings!

The Spider and the Bee.[1]—(Dean Swift.)

Upon the highest corner of a large window there dwelt a certain spider, swollen up to the first magnitude by the destruction of infinite numbers of flies whose spoils lay scattered before the gates of his palace, like human bones before the cave of some giant. The avenues of his castle were guarded with turnpikes and palisades, all after the modern way of fortification. After you had passed several courts you came to the centre, where you might behold the constable himself in his own lodgings, which had windows fronting to each avenue, and ports to sally out on all occasions of prey or defence. In this mansion he had for some time dwelt in peace and plenty, without danger to his person by swallows from above, or to his palace by brooms from below, when it was the pleasure of fortune to conduct thither a wandering bee, to whose curiosity a broken pane in the glass had discovered itself; and in he went; where, expatiating awhile, he at last happened to alight upon one of the outward walls of the spider's citadel, which, yielding to the unequal weight, sunk down to the very foundation. Thrice he endeavoured to force his passage, and thrice the centre shook. The spider within feeling the terrible convulsion, supposed at first that nature was approaching to her final dissolution, or else that Beelzebub with all his legions was come to revenge the death of many thousands of his subjects,[2] whom his enemy had slain and devoured. However, he at length valiantly resolved to issue forth and meet his fate. Meanwhile the bee had acquitted himself of his toils; and, posted securely at some distance, was employed in cleansing his wings, and disengaging them from the rugged remnants of the cobweb. By this time the spider was adventured out, when, beholding the chasms, the ruins and dilapidations of his fortress, he was very near at his wits' end, he stormed and swore like a madman, and

[1] Written to illustrate the superiority of the ancient over modern learning; the Bee representing the ancients; the Spider, the moderns.

[2] Beelzebub in the Hebrew signifies lord of flies.

swelled till he was ready to burst. At length casting his eye upon the bee, and wisely gathering causes from events (for they knew each other by sight), "A plague split you," said he, "for a giddy puppy; it is you, with a vengeance, that have made this litter here? Could you not look before you? Do you think I have nothing else to do than to mend and repair after you?" "Good words, friend," said the bee (having now pruned himself and being disposed to be droll): "I'll give you my hand and word to come near your kennel no more, I was never in such a confounded pickle since I was born!" "Sirrah," replied the spider, "if it were not for breaking an old custom in our family, never to stir abroad against an enemy, I should come and teach you better manners." "I pray have patience," said the bee, "or you'll spend your substance, and for aught I see, you may stand in need of it all towards the repair of your house." "Rogue, rogue," replied the spider; "yet methinks you should have more respect for a person whom all the world allows to be so much your betters." "By my troth," said the bee, "the comparison will amount to a very good jest; and you will do me a favour to let me know the reasons that all the world is pleased to use in so hopeful a dispute." At this the spider, having swelled himself to the size and posture of a disputant, began his argument in the true spirit of controversy, with resolution to be heartily scurrilous and angry; to urge his own reasons without the least regard to the answers or objections of his opposite; and fully predetermined in his mind against all conviction.

"Not to disparage myself," said he, "by the comparison with such a rascal, what art thou but a vagabond, without house or home, without stock or inheritance: born to no possession of your own but a pair of wings and a drone-pipe, your livelihood is a universal plunder upon nature. You are a freebooter over fields and gardens; and for the sake of stealing you will rob a nettle as easily as a violet: whereas, I am a domestic animal, furnished with a native stock within myself. This large castle (to show my improvements in the mathematics), is all built with my own hands, and the materials extracted altogether out of my own person."

"I am glad," answered the bee, "to hear you grant at least, that I am come honestly by my wings and my voice; for then, it seems, I am obliged to Heaven alone for my flights and my music; and Providence would never have bestowed on me two such gifts, without designing them for the noblest ends. I visit, indeed, all the flowers and blossoms of the field and garden; but whatever I collect thence enriches myself, without the least injury to their beauty, their smell or their taste. Now, for you and your skill in architecture and other mathematics, I have little to say: in that building of yours there might, for aught I know, have been labour and method enough; but by woful experience for us both, it is too plain the materials are naught, and I hope you will henceforth take warning, and consider duration and matter as well as method and art. You boast, indeed, of being obliged to no other creature, but of drawing and spinning out all from yourself; that is to say, if we may judge of the liquor in the vessel by what issues out, you possess a good plentiful store of dirt and poison in your breast; and though I would by no means lessen or disparage your genuine stock of either, yet I doubt you are somewhat obliged, for an increase of both, to a little foreign assistance. Your inherent portion of dirt does not fail of acquisitions, by sweepings exhaled from below; and one insect furnishes you with a share of poison to destroy another. So that, in short, the question comes all to this; whether is the nobler being of the two, that which, by a lazy contemplation of four inches round, by an overweening pride, feeding and engendering on itself, turns all into excrement and venom, producing nothing at all but flybane and a cobweb; or that which, by a universal range, with long search, much study, true judgment, and distinction of things, brings home honey and wax?"

The First Attempts at Commerce.—(Dr. Robertson.)

The original station allotted to man by his Creator was in the mild and fertile regions of the East. There the human race began its career of improvement; and, from the remains of sciences which were anciently cultivated, as well as of arts which were anciently exercised in India, we may conclude it to be one of the first countries in which men made any considerable progress in that career. The wisdom of the East was early celebrated, and its productions were early in request among distant nations. The intercourse, however, between different countries was carried on, at first, entirely by land. As the people of the East appear soon to have acquired complete dominion over the useful animals, they could early undertake the long and tiresome journeys which it was necessary to make, in order to maintain their intercourse, and by the provident bounty of Heaven they were furnished with a beast of burden, without whose aid it would have been impossible to accomplish them. The camel, by its persevering strength, by its moderation in the use of food, and the singularity of its internal structure, which enables it to lay in a stock of water sufficient for several days, put it in their power to convey bulky commodities through those deserts which must be traversed by all who travel from any of the countries west of the Euphrates, towards India. Trade was carried on in this manner, particularly by the nations near to the Arabian Gulf, from the earliest period to which historical information reaches. Distant journeys, however, would be undertaken at first only occasionally, and by a few adventurers. But by degrees, from attention to their mutual safety and comfort, numerous bodies of merchants assembled at stated times, and formed a temporary association, known afterwards by the name of a Caravan, governed by officers of their own choice, and subject to regulations, of which experience had taught them the utility; they performed journeys of such extent and duration, as appear astonishing to nations not accustomed to this mode of carrying on commerce.

But notwithstanding every improvement that could be made in the manner of conveying the productions of one country to another by land, the inconveniences which attended it were obvious and unavoidable. It was often dangerous, always expensive, and tedious and fatiguing. A method of communication more easy and expeditious was sought, and the ingenuity of man gradually discovered that the rivers, the arms of the sea, and even the ocean itself, were destined to open and facilitate intercourse with the various regions of the earth, between which they appear, at first view, to be placed as insuperable barriers. Navigation, however, and shipbuilding, as I have observed in another work, are arts so nice and complicated, that they require the talents, as well as experience, of many successive ages to bring them to any degree of perfection. From the raft or canoe which first served to carry a savage over the river that obstructed him in the chase, to the construction of a vessel capable of conveying a numerous crew or a considerable cargo of goods to a distant coast, the progress of improvement is immense. Many efforts would be made, many experiments would be tried, and much labour as well as ingenuity would be employed, before this arduous and important undertaking could be accomplished.

Even after some improvement was made in shipbuilding, the intercourse of nations with each other by sea was far from being extensive. From the accounts of the earliest historians, we learn that navigation made its first efforts in the Mediterranean and the Arabian Gulf; and in them the first active operations of commerce were carried on. From an attentive inspection of the position and form of these two great inland seas, these accounts appear to be highly probable. These seas lay open the continents of Europe, Asia, and Africa, and spreading to a great extent along the coasts of most fertile and most early civilized countries in each, seem to have been destined by nature to facilitate their communication with one another. We find, accordingly, that the first voyages of the Egyptians and Phœnicians, the most ancient navigators mentioned in history, were made in the Mediterranean. Their trade, however, was not long confined to the countries bordering upon it. By acquiring early possession of ports on the Arabian Gulf, they extended the sphere of their commerce, and are represented as the first people of the west who opened a communication by sea with India.

In that account of the progress of navigation and discovery, which I prefixed to the history of America, I considered with attention the maritime operations of the Egyptians and Phœnicians; a brief review of them here, as far as they relate to their connexion with India, is all that is requisite for illustrating the subject of my present inquiries. With respect to the former of these people, the information which history affords is slender, and of doubtful authority. The fertile soil and mild climate of Egypt produced the necessaries and comforts of life in such profusion as to render its inhabitants so independent of other countries, that it became early an established maxim in their policy to renounce all intercourse with foreigners. In consequence of this, they held all seafaring persons in detestation, as impious and profane, and, fortifying their harbours, they denied strangers admission into them.

The enterprising ambition of Sesostris disdained the restraints imposed upon it by these contracted ideas of his subjects, and prompted him to render the Egyptians a commercial people ; and in the course of his reign he so completely accomplished this, that if we may give credit to some historians, he was able to fit out a fleet of four hundred ships in the Arabian Gulf, which conquered all the countries stretching along the Erythrean sea to India. At the same time his army, led by himself, marched through Asia, and subjected to his dominion every port of it as far as to the banks of the Ganges ; and crossing that river, advanced to the Eastern Ocean. But these efforts produced no permanent effect, and appear to have been so contrary to the genius and habits of the Egyptians, that, on the death of Sesostris, they resumed their ancient maxims, and many ages elapsed before the commercial connexion of Egypt with India came to be of such importance as to merit any notice in this Disquisition.

The history of the early maritime operations of Phœnicia is not involved in the same obscurity with those of Egypt. Every circumstance in the character and situation of the Phœnicians was favourable to the commercial spirit. The territory which they possessed was neither large nor fertile ; it was from commerce only that they could derive either opulence or power. Accordingly, the trade carried on by the Phœnicians of Sidon and Tyre was extensive and adventurous ; and, both in their manners and policy, they resemble the great commercial states of modern times more than any people in the ancient world. Among the various branches of their commerce, that with India may be regarded as one of the most considerable and most lucrative. As by their situation on the Mediterranean, and the imperfect state of navigation, they could not attempt to open a direct communication with India by sea, the enterprising spirit of commerce prompted them to wrest from the Idumæans some commodious harbours towards the bottom of the Arabian Gulf.

From these they held a regular intercourse with India, on the one hand, and with the eastern and southern coasts of Africa on the other. The distance, however, from the Arabian Gulf to Tyre was considerable, and rendered the conveyance of goods to it by land-carriage so tedious and expensive that it became necessary for them to take possession of Rhinocolura, the nearest port in the Mediterranean to the Arabian Gulf. Thither all the commodities brought from India were conveyed overland, by a route much shorter and more practicable than that by which the productions of the East were carried, at a subsequent period, from the opposite shore of the Arabian Gulf to the Nile. At Rhinocolura they were re-shipped and transported, by an easy navigation, to Tyre, and distributed through the world. This, as it is the earliest route of communication with India of which we have any authentic description, had so many advantages over any ever known before the modern discovery of a new course of navigation to the East, that the Phœnicians could supply other nations with the productions of India in greater abundance, and at a cheaper rate, than any people of antiquity. To this circumstance, which, for a considerable time, secured to them a monopoly of that trade, was owing, not only the extraordinary wealth of individuals, which rendered the "merchants of Tyre princes, and her traffickers the honourable of the earth;" but the extensive power of the state itself, which first taught mankind to conceive what vast resources a commercial people possess, and what great exertions they are capable of making.—ROBERTSON'S *Disquisition on Ancient India.*

DEATH OF LITTLE NELL.—(CHARLES DICKENS.)

SHE was dead. No sleep so beautiful and calm, so free from trace of pain, so fair to look upon. She seemed a creature fresh from the hand of God, and waiting for the breath of life; not one who had lived and suffered death. Her couch was dressed with here and there some winter-berries and green leaves, gathered in a spot she had been used to favour. "When I die, put near me something that has loved the light, and had the sky above it always." Those were her words.

She was dead. Dear, gentle, patient, noble Nell was dead. Her little bird—a poor, slight thing the pressure of a finger would have crushed—was stirring nimbly in its cage, and the strong heart of its child-mistress was mute and motionless for ever! Where were the traces of her early cares, her sufferings, and fatigues? All gone. Sorrow was dead, indeed, in her; but peace and perfect happiness were born—imaged—in her tranquil beauty and profound repose.

And still her former self lay there, unaltered in this change. Yes! the old fireside had smiled upon that same sweet face; it had passed, like a dream, through haunts of misery and care; at the door of the poor schoolmaster on the summer evening, before the furnace-fire upon the cold wet night, at the still bedside of the dying boy, there had been the same mild and lovely look. So shall we know the angels, in their majesty, after death.

The old man held one languid arm in his, and the small tight hand folded to his breast for warmth. It was the hand she had stretched out to him with her last smile,—the hand that had led him on through all their wanderings. Ever and anon he pressed it to his lips; then hugged it to his breast again, murmuring that it was warmer now; and, as he said it, he looked in agony to those who stood around, as if imploring them to help her.

She was dead, and past all help, or need of help. The ancient rooms she had seemed to fill with life, even while her own was waning fast, the garden she had tended, the eyes she had gladdened, the noiseless haunts of many a thoughtful hour, the paths she had trodden, as it were but yesterday, could know her no more. "It is not," said the schoolmaster, as he bent down to kiss her on the cheek, and gave his tears free vent, "it is not in *this* world that Heaven's justice ends. Think what it is, compared with the world to which her young spirit has winged its early flight, and say, if one deliberate wish, expressed in solemn tones above this bed, could call her back to life, which of us would utter it!"

She had been dead two days. They were all about her at the time, knowing that the end was drawing on. She died soon after daybreak. They had read and talked to her in the earlier portion of the night; but as the hours crept on, she sank to sleep. They could tell by what she faintly uttered in her dreams, that they were of her wanderings with the old man; they were of no painful scenes but of those who had helped them, and used them kindly; for she often said "God bless you!" with great fervour. Waking, she never wandered in her mind but once, and that was at beautiful music, which, she said, was in the air. God knows. It may have been. Opening her eyes at last, from a very quiet sleep, she begged that they would kiss her once again. That done, she turned to the old man, with a lovely smile upon her face—such, they said, as they had never seen, and never could forget—and clung, with both her arms, about his neck. She had never murmured or complained; but, with a quiet mind, and manner quite unaltered—

save that she every day became more earnest and more grateful to them—faded like the light upon the summer's evening.

The child who had been her little friend, came there almost as soon as it was day, with an offering of dried flowers, which he begged them to lay upon her breast. He told them of his dream again, and that it was of her being restored to them, just as she used to be. He begged hard to see her: saying that he would be very quiet, and that they need not fear his being alarmed, for he had sat alone by his younger brother all day long when he was dead, and had felt glad to be so near him. They let him have his wish; and, indeed, he kept his word, and was, in his childish way, a lesson to them all.

Up to that time, the old man had not spoken once—except to her—or stirred from the bedside. But, when he saw her little favourite, he was moved as they had not seen him yet, and made as though he would have him come nearer. Then, pointing to the bed, he burst into tears for the first time, and they who stood by, knowing that the sight of this child had done him good, left them alone together.

Soothing him with his artless talk of her, the child persuaded him to take some rest, to walk abroad, to do almost as he desired him. And, when the day came, on which they must remove her, in her earthly shape, from earthly eyes for ever, he led him away, that he might not know when she was taken from him. They were to gather fresh leaves and berries for her bed.

And now the bell—the bell she had so often heard by night and day, and listened to with solemn pleasure, almost as a living voice, rung its remorseless toll for her, so young, so beautiful, so good. Decrepit age, and vigorous life, and blooming youth, and helpless infancy, poured forth—on crutches, in the pride of health and strength, in the full blush of promise, in the mere dawn of life—to gather round her tomb. Old men were there, whose eyes were dim and senses failing,—grandmothers, who might have died ten years ago, and still been old,—the deaf, the blind, the lame, the palsied,—the living dead, in many shapes and forms, to see the closing of that early grave.

Along the crowded path they bore her now—pure as the newly fallen snow that covered it—whose day on earth had been as fleeting. Under that porch where she had sat, when Heaven, in its mercy, brought her to that peaceful spot, she passed again, and the old church received her in its quiet shade. They carried her to one old nook, where she had, many and many a time, sat musing, and laid their burden softly on the pavement. The light streamed on it through the coloured window—a window where the boughs of trees were ever rustling in the summer, and where the birds sang sweetly all day long. With every breath of air that stirred among those branches in the sunshine, some trembling, changing light would fall upon her grave.

Earth to earth, ashes to ashes, dust to dust. Many a young hand dropped in its little wreath,—many a stiffled sob was heard. Some, and they were not a few, knelt down. All were sincere and truthful in their sorrow. The service done, the mourners stood apart, and the villagers closed round to look into the grave, before the stone should be replaced. One called to mind how he had seen her sitting on that very spot, and how her book had fallen on her lap, and she was gazing with a pensive face upon the sky. Another told how he had wondered much, that one so delicate as she should be so bold; how she had never feared to enter the church alone, at night, but had loved to linger there, when all was quiet; and even to climb the tower-stair, with no more light than that of the moon-rays stealing through the loopholes in the thick old walls. A whisper went about among the oldest there, that she had seen and talked with angels; and, when they called to mind how she had looked and spoken, and her early death, some thought it might be so indeed.

Thus, coming to the grave in little knots, and glancing down, and giving place to others, and falling off in whispering groups of three or four, the church was cleared, in time, of all but the sexton and the mourning friends. Then, when the dusk of evening had come on, and not a sound disturbed the sacred stillness of the place,—when the bright moon poured in her light on tomb and monument, on pillar, wall, and arch,—and, most of all it seemed to them, upon her quiet grave,—in that calm time, when all outward things and inward thoughts teem with assurances of immortality, and worldly hopes and fears are humbled in the dust before them, then with tranquil and submissive hearts, they turned away, and left the child with God.

ON CIVILISATION.—(GUIZOT.)

THE term *civilisation* has been used for a long period of time, and in many countries. Ideas more or less limited, more or less comprehensive, are attached to it, but still it is adopted and understood. It is the sense of this word, the general, human, and popular sense, that we must study. There is almost always more truth in the usual acceptation of general terms, than in the apparently more precise and hard definitions of science. Common sense has given to words their ordinary signification, and common sense is the genius of mankind.

I shall describe a certain number of states of society, and then we may see if common instinct can point out the civilized state of society, the state which exemplifies the meaning that mankind naturally attaches to the term *civilisation.*

Suppose a people whose external life is pleasant and easy; they pay few taxes, they have no hardships; justice is well administered in all private relations; in a word, material existence, taken as a whole, is well and happily regulated. But at the same time the intellectual and moral existence of this people is carefully kept in a state of torpor and sluggishness; I do not say, of oppression. because that feeling does not exist among them, but of compression. This state of things is not without example. There have been a great number of small aristocratic republics where the people have been thus treated like flocks, well attended and corporeally happy, but without intellectual and moral activity. Is this civilisation? Is this a people civilizing itself?

Here is another hypothesis. Suppose a people whose material existence is less easy, less agreeable, but endurable nevertheless. In compensation, their moral and intellectual wants have not been neglected; a certain amount of mental food is distributed to them; pure and elevated sentiments are cultivated among the people; their moral and religious opinions have attained a certain degree of development: but great care is taken to extinguish the principle of liberty; satisfaction is given to intellectual and moral wants, as elsewhere to material wants; to each is given his portion of truth, no one is permitted to seek it by himself. Immobility is the character of the moral life we are describing. This is the state into which the greater part of the populations of

Asia have fallen, where theocratical dominion holds back humanity: this is the condition of the Hindus, for example. I ask the same question as about the preceding people: is this a people civilizing itself?

I will now completely change the nature of the hypothesis. Imagine a people among whom there is a great display of some individual liberties, but among whom disorder and inequality are excessive: strength and chance have the dominion; every one, if he is not strong, is oppressed, suffers, and perishes; violence is the ruling character of the social state. Everybody is aware that Europe has passed through this state. Is it a civilized state? It may doubtless contain the principles of civilisation which will develop themselves by degrees, but the acting principle of such a society is not, unquestionably, what the judgment of men calls *civilisation.*

I take a fourth and last hypothesis. The liberty of each individual is very great, inequality between them is rare, or at least very transient. Every one does nearly what he likes, and in power differs little from his neighbours; but there are very few general interests, very few public ideas, in a word, very little sociability: the faculties and existence of each individual come forth and flow on in isolation, without one influencing the other, and without leaving any trace behind; successive generations leave society at the same point at which they found it. This is the condition of savage tribes; liberty and equality exist, and yet, most certainly, civilisation does not.

I could multiply these hypotheses; but I think I have brought forward sufficient to elucidate the popular and natural meaning of the word *civilisation.* It is clear that none of the conditions I have just sketched answers, according to the natural and right understanding of men, to this term. Why not? It appears to me that the first fact which is comprehended in the word *civilisation* is the fact of progress, of development; it immediately gives the idea of a people, going on, not to change its place, but to change its condition; of a people whose condition becomes extended and ameliorated. The idea of progression, of development, seems to me to be the fundamental idea contained in the word *civilisation.*

What is this progression? What is this development? Here lies the greatest difficulty we have to encounter.

The etymology of the word seems to answer in a clear and satisfactory manner ; it tells us that it means the perfecting of civil life, the development of society properly so called, of the relations of men among themselves. Such is in fact the first idea that offers itself to the minds of men, when they utter the word *civilisation :* they directly think of the extension, the greatest activity, and the best organization of all social relations ; on the one hand an increasing production of means of power and prosperity in society ; on the other, a more equal distribution, among individuals, of the power and the prosperity produced. Is this all ? Have we exhausted the natural and common meaning of the word *civilisation ?* Does it contain nothing more ? This is almost as if we asked—Is the human species after all merely an ant-hill, a society where it is merely a question of order and prosperity, where the greater the amount of work done, and the more equitable the division of the fruits of that work, the more the aim is attained, and the progress accomplished ? The instinct of men repels so limited a definition of human destiny.

It appears, at the first view, that the word *civilisation* comprehends something more extended, more complex, superior to the mere perfection of social relations, of social power, and prosperity. Facts, public opinion, the generally received meaning of the term, agree with this instinct. Take Rome in the prosperous time of the republic, after the Second Punic War, at the moment of her greatest power, when she was marching to the conquest of the world, when her social state was evidently progressing. Then take Rome under Augustus, at the time when her fall commenced, at least when the progressive movement of society was arrested, when evil principles were on the point of prevailing. Yet there is no one who does not think and does not say that the Rome of Augustus was more civilized than the Rome of Fabricius or of Cincinnatus.

Let us go elsewhere ; let us take the France of the seventeenth and eighteenth centuries : it is evident, in a social point of view, that as to the amount and distribution of prosperity among individuals, the France of the seventeenth and eighteenth centuries was inferior to some other countries of Europe, to Holland and to England, for example. I think that in Holland and in England social activity was greater, was increasing more rapidly, and distributing its fruits better than in France. Yet consult the judgment of men ; that will tell you that France in the seventeenth and eighteenth centuries was the most civilized country of Europe. Europe has not hesitated in answering this question. We find traces of this public opinion respecting France in all the monuments of European literature.

We could point out other states where prosperity is greater, increases more rapidly, and is better divided among individuals than elsewhere, and yet where, by spontaneous instinct, in the judgment of men, the civilisation is considered inferior to that of other countries whose purely social relations are not so well regulated.

What is to be said? What do these countries possess, what gives them this privileged right to the name of civilized, which compensates so largely, in the opinion of men, for what they want in other respects?

Another development, besides that of social life, is in them strikingly manifested; the development of individual life, of internal life, the development of man himself, of his faculties, of his sentiments—of his ideas. If society is more imperfect than elsewhere, humanity appears with more grandeur and power. There remain many social conquests to make, but immense intellectual and moral conquests are accomplished; many men stand in need of many benefits and many rights; but many great men live and shine before the world. Literature, science, and the arts display all their splendour. Wherever mankind sees these great types, these glorified images of human nature shining, wherever he sees this treasury of sublime enjoyments progressing, then he recognises it as, and calls it, *civilisation.*

Two facts, then, are comprised in this great fact: it subsists on two conditions, and shows itself by two symptoms; the development of social activity, and of individual activity, the progress of society, and the progress of humanity. Wherever the external condition is extended, vivified, and ameliorated; wherever the internal nature of man displays itself with brilliancy and grandeur; by these two signs, and often in spite of the profound imperfection of the social state, mankind applauds and proclaims civilisation.

EDUCATION.—(ADDISON.)

I CONSIDER a human soul, without education, like marble in the quarry; which shows none of its inherent beauties, until the skill of the polisher fetches out the colours, makes the surface shine, and discovers every ornamental cloud, spot, and vein, that runs through the body of it. Education, after the same manner, when it works upon a noble mind, draws out to view every latent virtue and perfection, which, without such helps, are never able to make their appearance.

If my reader will give me leave to change the allusion so soon upon him, I shall make use of the same instance to illustrate the force of education, which Aristotle has brought to explain his doctrine of substantial forms, when he tells us, that a statue lies hid in a block of marble; and that the art of the statuary only clears away the superfluous matter and removes the rubbish. The figure is in the stone, and the sculptor only finds it. What sculpture is to a block of marble, education is to a human soul. The philosopher, the saint, or the hero; the wise, the good, or the great man, very often lies hid and concealed in a plebeian, which a proper education might have disinterred, and have brought to light. I am therefore much delighted with reading the accounts of savage nations, and with contemplating those virtues which are wild and uncultivated; to see courage exerting itself in fierceness, resolution in obstinacy, wisdom in cunning, patience in sullenness and despair.

It is an unspeakable blessing to be born in those parts of the world where wisdom and knowledge flourish; though it must be confessed there are, even in these parts, several poor uninstructed persons, who are but little above the inhabitants of those nations of which I have been here speaking; as those who have had the advantages of a more liberal education, rise above one another by several different degrees of perfection. For, to return to our statue in the block of marble, we see it sometimes only begun to be chipped; sometimes rough-hewn, and but just sketched into a human figure; sometimes we see the man appearing distinctly in all his limbs and features; sometimes we find the figure wrought up to great elegancy; but seldom meet with any, to which the hand of a Phidias or a Praxiteles could not give several nice touches and finishings.

The Mountain of Miseries.—(Addison.)

It is a celebrated thought of Socrates, that, if all the misfortunes of mankind were cast into a public stock, in order to be equally distributed among the whole species, those who now think themselves the most unhappy, would prefer the share they are already possessed of, before that which would fall to them by such a division. Horace has carried this thought a great deal further, which implies, that the hardships or misfortunes we lie under, are more easy to us than those of any other person would be, in case we could exchange conditions with him.

As I was ruminating upon these two remarks, and seated in my elbow-chair, I insensibly fell asleep; when, on a sudden, methought there was a proclamation made by Jupiter, that every mortal should bring in his griefs and calamities, and throw them together in a heap. There was a large plain appointed for this purpose. I took my stand in the centre of it, and saw, with a great deal of pleasure, the whole human species, marching one after another, and throwing down their several loads, which immediately grew up into a prodigious mountain, that seemed to rise above the clouds.

There was a certain lady, of thin, airy shape, who was very active in this solemnity. She carried a magnifying-glass in one of her hands, and was clothed in a loose, flowing robe, embroidered with several figures of fiends and spectres, that discovered themselves in a thousand chimerical shapes as her garments hovered in the wind. There was something wild and distracted in her looks. Her name was Fancy. She led up every mortal to the appointed place, after having very officiously assisted him in making up his pack, and laying it upon his shoulders. My heart melted within me, to see my fellow-creatures groaning under their respective burdens, and to consider that prodigious bulk of human calamities which lay before me.

There were, however, several persons who gave me great diversion upon this occasion. I observed one bringing in a parcel, very carefully concealed under an old embroidered cloak, which, upon his throwing it into the heap, I discovered to be poverty. Another. after a great deal of puffing, threw down his luggage, which, upon examining, I found to be his wife.

There were multitudes of lovers, saddled with very whimsical burdens, composed of darts and flames; but, what was very odd, though they sighed as if their hearts would break under these bundles of calamities, they could not persuade themselves to cast them into the heap, when they came up to it; but after a few faint efforts, shook their heads, and marched away as heavy-laden as they came. I saw multitudes of old women throw down their wrinkles, and several young ones who stripped themselves of a tawny skin. There were very great heaps of red noses, large lips, and rusty teeth.

The truth of it is, I was surprised to see the greatest part of the mountain made up of bodily deformities. Observing one advancing toward the heap with a larger cargo than ordinary upon his back, I found, upon his near approach, that it was only a natural hump, which he disposed of, with great joy of heart, among this collection of human miseries. There were likewise distempers of all sorts; though I could not but observe that there were many more imaginary than real.

One little packet I could not but take notice of, which was a complication of all the diseases incident to human nature, and was in the hand of a great many fine people; this was called the spleen. But, what most of all surprised me, was a remark I made, that there was not a single vice or folly thrown into the whole heap; at which I was very much astonished, having concluded within myself, that every one would take this opportunity of getting rid of his passions, prejudices, and frailties.

I took notice, in particular, of a very profligate fellow, who, I did not question, came loaded with his crimes; but, upon searching into his bundle, I found that, instead of throwing his guilt from him, he had only laid down his memory. He was followed by another worthless rogue, who flung away his modesty, instead of his ignorance.

When the whole race of mankind had thus cast their burdens, the Phantom which had been so busy on this occasion, seeing me an idle spectator of what passed, approached toward me. I grew uneasy at her presence, when, of a sudden, she held her magnifying-glass full before my eyes. I no sooner saw my face in it, than I was startled at the shortness of it, which now appeared to me in its utmost aggravation. The immoderate breadth of the features made me very much out of humour with my own countenance; upon which I threw it from me like a mask. It happened, very luckily, that one who stood by me had just before thrown down his visage, which, it seems, was too long for him. It was, indeed, extended to a most shameful length; I believe the very chin was, modestly speaking, as long as my whole face.

We had both of us an opportunity of mending ourselves; and all the contributions being now brought in, every man was at liberty to exchange his misfortunes for those of another person. I saw, with unspeakable pleasure, the whole species thus delivered from its sorrows; though, at the same time, as we stood round the heap and surveyed the several materials of which it was composed, there was scarcely a mortal in this vast multitude who did not discover what he thought pleasures and blessings of life, and wondered how the owners of them ever came to look upon them as burdens and grievances.

As we were regarding very attentively this confusion of miseries, this chaos of calamity, Jupiter issued out a second proclamation, that every one was now at liberty to exchange his affliction, and to return to his habitation with any such bundle as should be allotted to him. Upon this, Fancy began again to bestir herself, and parcelling out the whole heap with incredible activity, recommended to every one his particular packet. The hurry and confusion at this time was not to be expressed. Some observations which I made upon the occasion I shall communicate to the public: A poor galley-slave, who had thrown down his chains, took up the gout instead; but made such wry faces that one might easily perceive he was no great gainer by the bargain. It was pleasant enough to see the several exchanges that were made, for sickness against poverty, hunger against want of appetite, and ease against pain. The female world were busy among themselves in bartering for features: one was trucking a lock of grey hairs for a carbuncle: another was making over a short waist for a pair of round shoulders; and a third cheapening a bad face for a lost reputation; but, on all these occasions, there was not one of them who did not think the new blemish, as soon as she got it into her possession, much more disagreeable than the old one. I made the same observation on every other misfortune or calamity which every one in the assembly brought upon himself, in lieu of what he had parted with; whether it be that all the evils which befall us are in some measure suited and proportioned to our strength, or that any evil becomes more supportable by our being accustomed to it, I shall not determine.

I must not omit my own particular adventure. My friend with a long visage had no sooner taken upon him my short face, but he made such a grotesque figure in it, that, as I looked upon him, I could not forbear laughing at myself, insomuch that I put my own face out of countenance. The poor gentleman was so sensible of the ridicule, that I found he was ashamed of what he had done : on the other side, I found that I myself had no great reason to triumph ; for, as I bent to touch my forehead, I missed the place, and clapped my finger upon my upper lip ! Besides, as my nose was exceedingly prominent, I gave it two or three unlucky knocks as I was playing my hand about my face, and aiming at some other part of it. I saw two other gentlemen by me, who were in the same ridiculous circumstances.

The heap was at last distributed among the two sexes, who made a most piteous sight, as they wandered up and down under the pressure of their several burdens. The whole plain was filled with murmurs and complaints, groans and lamentations. Jupiter, at length, taking compassion on the poor mortals, ordered them a second time to lay down their loads, with a design to give every one his own again. They discharged themselves with a great deal of pleasure ; after which, the Phantom who had led them into such gross delusions, was commanded to disappear. There was sent in her stead a goddess of a quite different figure : her motions were steady and composed, and her aspect serious but cheerful. She every now and then cast her eyes towards heaven, and fixed them upon Jupiter. Her name was Patience. She had no sooner placed herself by the mount of sorrows, but, what I thought very remarkable, the whole heap sunk to such a degree, that it did not appear a third part as big as it was before. She afterwards returned every man his own proper calamity, and, teaching him how to bear it in the most commodious manner, he marched off with it contentedly, being very well pleased that he had not been left to his own choice as to the kind of evils which fell to his lot.

Besides the several pieces of morality to be drawn out of this vision, I learned from it never to repine at my own misfortunes, or to envy the happiness of another, since it is impossible for any man to form a right judgment of his neighbour's sufferings ; for which reason, also, I have determined never to think too lightly of another's complaints, but to regard the sorrows of my fellow-creatures with sentiments of humanity and compassion.

Labour and Genius.—(Sydney Smith.)

The prevailing idea with young people has been, the incompatibility of labour and genius; and, therefore, from the fear of being thought dull, they have thought it necessary to remain ignorant. I have seen, at school and at college, a great many young men completely destroyed by having been so unfortunate as to produce an excellent copy of verses. Their genius being now established, all that remained for them to do, was to act up to the dignity of the character; and as this dignity consisted in reading nothing new, in forgetting what they had already read, and in pretending to be acquainted with all subjects by a sort of offhand exertion of talents, they soon collapsed into the most frivolous and insignificant of men.

It would be an extremely profitable thing to draw up a short and well-authenticated account of the habits of study of the most celebrated writers with whose style of literary industry we happen to be most acquainted. It would go very far to destroy the absurd and pernicious association of genius and idleness, by showing that the greatest poets, orators, statesmen, and historians—men of the most brilliant and imposing talents—have actually laboured as hard as the makers of dictionaries and the arrangers of indexes; and that the most obvious reason why they have been superior to other men, is, that they have taken more pains than other men. Gibbon was in his study every morning, winter and summer, at six o'clock: Burke was the most laborious and indefatigable of human beings: Leibnitz was never out of his library; Pascal killed himself by study: Cicero narrowly escaped death from the same cause: Milton was at his books with as much regularity as a merchant or an attorney: he had mastered all the knowledge of his time: so had Homer. Raphael lived but thirty-seven years; and in that short space carried the art of painting so far beyond what it had before reached, that he appears to stand alone as a model to his successors.

There are instances to the contrary; but, generally speaking, the life of all truly great men has been a life of intense and incessant labour. They have commonly passed the first half of life in the gross darkness of indigent humility—overlooked, mistaken, contemned, by weaker men—thinking while others slept, reading while others rioted, feeling something within them, that told them they should not always be kept down among the dregs of the world. And then, when their time was come, and some little accident has given them their first occasion, they have burst out into the light and glory of public life, rich with the spoils of time, and mighty in all the labours and struggles of the mind. Then do the multitude cry out "a miracle of genius!" Yes, he is a miracle of genius, because he is a miracle of labour; because, instead of trusting to the resources of his own single mind, he has ransacked a thousand minds; because he makes use of the accumulated wisdom of ages, and takes, as his point of departure, the very last line and boundary to which science has advanced; because it has ever been the object of his life to assist every intellectual gift of nature, however munificent, and however splendid, with every resource that art could suggest, and every attention diligence could bestow.

But, while I am descanting upon the conduct of the understanding, and the best mode of acquiring knowledge, some men may be disposed to ask: "Why conduct my understanding with such endless care; and what is the use of so much knowledge?" What is the use of so much knowledge? What is the use of so much life? What are we to do with the seventy years of existence allotted to us? and how are we to live them out to the last? I solemnly declare that, but for the love of knowledge, I should consider the life of the meanest hedger and ditcher as preferable to that of the greatest and richest man in existence; for the fire of our minds is like the fire which the Persians burn on the mountains: it flames night and day and is immortal, and not to be quenched! Upon something it must act and feed—upon the pure spirit of knowledge, or upon the foul dregs of polluting passions.

Therefore, when I say, in conducting your understanding, love knowledge with a great love, with a vehement love, with a love coëval with life, what do I say but love innocence; love virtue; love purity of conduct; love that which, if you are rich and great, will vindicate the blind fortune which has made you so, and make men call it justice; love that which, if you are poor, will render your poverty respectable, and make the proudest feel it unjust to laugh at the meanness of your fortunes; love that which will comfort you, adorn you, and never quit you—which will open to you the kingdom of thought, and all the boundless regions of conception, as an asylum against the cruelty, the injustice, and the pain, that may be your lot in the outer world—that which will make your motives habitually great and honourable, and light up in an instant a thousand noble disdains at the very thought of meanness and of fraud.

Therefore, if any young man have embarked his life in pursuit of knowledge, let him go on without doubting or fearing the event; let him not be intimidated by the cheerless beginnings of knowledge, by the darkness from which she springs, by the difficulties which hover around her, by the wretched habitations in which she dwells, by the want and sorrow which sometimes journey in her train; but let him ever follow her as the Angel that guards him, and as the Genius of his life. She will bring him out at last into the light of day, and exhibit him to the world comprehensive in acquirements, fertile in resources, rich in imagination, strong in reasoning, prudent and powerful above his fellows in all the relations and in all the offices of life.

The Two Roads.—(Jean Paul Richter.)

It was New-Year's night. An aged man was standing at a window. He raised his mournful eyes toward the deep blue sky, where the stars were floating, like white lilies, on the surface of a clear calm lake. Then he cast them on the earth, where few more hopeless beings than himself now moved toward their certain goal—the tomb.

Already he had passed sixty of the stages which lead to it, and he had brought from his journey nothing but errors and remorse. His health was destroyed, his mind vacant, his heart sorrowful, and his old age devoid of comfort.

The days of his youth rose up in a vision before him, and he recalled the solemn moment when his father had placed him at the entrance of two roads,—*one* leading into a peaceful, sunny land, covered with a fertile harvest, and resounding with soft sweet songs; the *other* leading the wanderer into a deep, dark cave, whence there was no issue, where poison flowed instead of water, and where serpents hissed and crawled.

He looked toward the sky, and cried out in his agony: "O youth, return! O my father, place me once more at the entrance to life, that I may choose the better way!" But the days of his youth and his father had both passed away.

He saw wandering lights floating away over dark marshes, and then disappear. *These* were the days of his wasted life. He saw a star fall from heaven, and vanish in darkness. This was an emblem of himself; and the sharp arrows of unavailing remorse struck home to his heart. Then he remembered his early companions, who entered on life with him, but who, having trod the paths of virtue and of labour, were now honoured and happy on this New Year's night.

The clock, in the high church tower, struck, and the sound, falling on his ear, recalled his parents' early love for him, their erring son; the lessons they had taught him; the prayers they had offered up on his behalf. Overwhelmed with shame and grief, he dared no longer look toward that heaven where his father dwelt; his darkened eyes dropped tears, and with one despairing effort, he cried aloud: "Come back, my early days! come back!"

And his youth *did* return; for all this was but a dream which visited his slumbers on New-Year's night. He was still young; his faults alone were real. He thanked God fervently, that time was still his own; that he had not yet entered the deep, dark cavern, but that he was free to tread the road leading to the peaceful land, where sunny harvests wave.

Ye who still linger on the threshold of life, doubting which path to choose, remember that, when years are passed, and your feet stumble on the dark mountain, you will cry bitterly, but cry in vain: "O youth, return! O give me back my early days!"

On the Abuse of Words.—(John Locke.)

Besides the imperfection that is naturally in language, and the obscurity and confusion that is so hard to be avoided in the use of words, there are several wilful faults and neglects, which men are guilty of in this way of communication, whereby they render these signs less clear and distinct in their signification than naturally they need to be.

The first and most palpable abuse is, the using of words without clear and distinct ideas, or, which is worse, signs without anything signified. Of these there are two sorts :

1. One may observe, in all languages, certain words that, if they be examined, will be found, in their first original, and their appropriated use, not to stand for any clear and distinct ideas. These, for the most part, the several sects of philosophy and religion have introduced. For their authors, or promoters, either affecting something singular, and out of the way of common apprehensions, or to support some strange opinions, or cover some weakness of their hypothesis, seldom fail to coin new words, and such as, when they come to be examined, may justly be called non-significant terms. For having either had no determinate collection of ideas annexed to them, when they were first invented ; or at least such as, if well examined, will be found inconsistent, it is no wonder if, afterwards, in the vulgar use of the same party, they remain empty sounds, with little or no signification, amongst those who think it enough to have them often in their mouths, as the distinguishing characteristics of their church or school, without much troubling their heads to examine what are the precise ideas they stand for. * * *

Others there be who extend this abuse yet further, who by an unpardonable negligence, they familiarly use words, which the propriety of language has affixed to very important ideas, without any distinct meaning at all. Wisdom, glory, grace, &c., are words frequent enough in every man's mouth ; but if a great many of those who use them should be asked what they mean by them, they would be at a stand, and not know what to answer ; a plain proof, that, though they have learned those sounds, and have them ready at their tongue's end, yet there are no determined ideas laid up in their minds, which are to be expressed to others by them.

Men having been accustomed from their cradles to learn words, which are easily got and retained, before they knew or had framed the complex ideas to which they were annexed, or which were to be found in the things they were thought to stand for, they usually continue to do so all their lives ; and without taking the pains necessary to settle in their minds determined ideas, they use their words for such unsteady and confused notions as they have, contenting themselves with the same words other people use, as if their very sound necessarily carried with it constantly the same meaning. Though men make a shift with this, in the ordinary occurrences of life, where they find it necessary to be understood, and, therefore, they make signs till they are so: yet the non-significancy in their words, when they come to reason concerning either their tenets or interests, manifestly fills their discourse with abundance of empty unintelligible noise and jargon, especially in moral matters; where the words, for the most part, standing for arbitrary and numerous collections of ideas, not regularly and permanently united in nature, their bare sounds are often only thought on, or at most very obscure and uncertain notions annexed to them. * *

Secondly, Another great abuse of words, is inconstancy in the use of them. It is hard to find a discourse written upon any subject, especially of controversy, wherein one shall not observe, if he read with attention, the same words (and those commonly the most material in the discourse, and upon which the argument turns) used sometimes for one collection of simple ideas, and sometimes for another, which is a perfect abuse of language. Words being intended for signs of my ideas, to make them known to others, not by any natural signification, but by a voluntary imposition, it is plain cheat and abuse when I make them stand sometimes for one thing and sometimes for another; the wilful doing whereof can be imputed to nothing but great folly, or greater dishonesty. And a man, in his accounts with another, may, with as much fairness, make the characters of numbers stand sometimes for one, and sometimes for another, collection of units (*e.g.*, this character 3 stand sometimes for three, sometimes for four, and sometimes for eight), as in his discourse, or reasoning, make the same words stand for different collections of simple ideas. * *

Thirdly, Another abuse of language is an affected obscurity, by either applying all words to new and unusual significations, or introducing new and ambiguous terms, without defining either; or else putting them so together, as may confound their ordinary meaning. Though the peripatetic philosophy has been most eminent in this way, yet other sects have not been wholly clear of it. There are scarce any of them that are not cumbered with some difficulties (such is the imperfection of human knowledge), which they have been fain to cover with obscurity of terms, and to confound the signification of words, which, like the mist before people's eyes, might hinder their weak parts from being discovered. * *

Fourthly, Another great abuse of words is the taking them for things. This, though it in some degree concerns all names in general, yet more particularly affects those of substances. To this abuse those men are most subject who most confine their thoughts to any one system, and give themselves up into a firm belief of the perfection of any received hypothesis; whereby they come to be persuaded, that the terms of that sect are so suited to the nature of things that they perfectly correspond with their real existence. Who is there that has been bred up in the peripatetic philosophy, who does not think the ten names, under which are ranked the ten predicaments, to be exactly conformable to the nature of things? Who is there of that school that is not persuaded that substantial forms, vegetative souls, abhorrence of a vacuum, intentional species, &c., are something real? These words men have learned from their very entrance upon knowledge, and have found their masters and systems lay great stress upon them; and therefore they cannot quit the opinion that they are conformable to nature, and are the representations of something that really exists.

Fifthly, Another abuse of words is the setting them in the place of things which they do or can by no means signify. * *

Sixthly, There remains yet another more general, though perhaps less observed, abuse of words; and that is, that men having by a long and familiar use annexed to them certain ideas, they are apt to imagine so near and necessary a connexion between the names and the signification they use them in, that they forwardly suppose one cannot but understand what their meaning is; and therefore one ought to acquiesce in the words delivered, as if it were past doubt, that in the use of those common received sounds, the speaker and hearer had necessarily the same precise ideas. Whence presuming, that when they have in discourse used any term, they have thereby, as it were, set before others the very thing they talk of. And so likewise, taking the words of others, as standing precisely for what they themselves have been accustomed to apply them to, they never trouble themselves to explain their own, or understand clearly others' meaning. From whence commonly proceed noise and wrangling, without improvement or information; whilst men take words to be the constant regular marks of agreed notions, which, in truth, are no more but the voluntary and unsteady signs of their own ideas. And yet men think it strange, if in discourse, or (where it is often absolutely necessary) in dispute, one sometimes asks the meaning of their terms: though the arguings one may every day observe in conversation, make it evident, that there are few names of complex ideas, which any two men use precisely for the same collection. It is hard to name a word which will not be a clear instance of this. *Life* is a term: none more familiar. Any one almost would take it for an affront, to be asked what he meant by it. And yet if it comes in question whether a plant that lies ready formed in the seed have life; whether the embryo of an egg before incubation, or a man in a swoon, without sense or motion, be alive or no? it is easy to perceive that a clear distinct settled idea does not always accompany the use of so known a word as that of *life*. Some gross and confused conceptions men, indeed, ordinarily have, to which they apply the common words of their language, and such a loose use of their words serves them well enough in their ordinary discourses or affairs. But this is not sufficient for philosophical inquiries. Knowledge and reasoning require precise determinate ideas. And though men will not be so importunately dull, as not to understand what others say, without demanding an explication of their terms; nor so troublesomely critical, as to correct others in the use of the words they receive from them; yet where truth and knowledge are concerned in the case, I know not what fault it can be to desire the explication of words whose sense seems dubious; or why a man should be ashamed to own his ignorance in what sense another man uses his words, since he has no other way of certainly knowing it, but by being informed. This abuse of taking words upon trust has nowhere spread so far, nor with so ill effects, as amongst men of letters. The multiplication and obstinacy of disputes, which have so laid waste the intellectual world, is owing to nothing more than to this ill use of words. For though it be generally believed that there is great diversity of opinions in the volumes and variety of controversies the world is distracted with, yet the most I can find that the contending learned men of different parties do, in their arguings one with another, is, that they speak different languages. For I am apt to imagine, that when any of them, quitting terms, think upon things, and know what they think, they think all the same: though perhaps what they would have be different. * *

This having been the fate or misfortune of a great part of men of letters, the increase brought into the stock of real knowledge has been very little, in proportion to the schools, disputes, and writings, the world has been filled with; whilst students being lost in the great wood of words, knew not whereabouts they were, how far their discoveries were advanced, or what was wanting in their own, or in the general stock of knowledge.

THE HOMES OF THE VERY POOR.—(CHARLES LAMB.)

HOMES there are, we are sure, that are no homes—the home of the very poor man, and another which we shall speak to presently. Crowded places of cheap entertainment, and the benches of ale-houses, if they could speak, might bear mournful testimony to the first. To them the very poor man resorts for an image of the home which he cannot find at home. For a starved grate and a scanty firing that is not enough to keep alive the natural heat in the fingers of so many shivering children, with their mother, he finds in the depths of winter always a blazing hearth, and a hob to warm his pittance of beer by. Instead of the clamours of a wife, made gaunt by famishing, he meets with a cheerful attendance beyond the merits of the trifle which he can afford to spend. All this while he deserts his wife and children. But what wife, and what children? Prosperous men, who object to this desertion, image to themselves some clean contented family like that which they go home to. But look at the countenance of the poor wives who follow and persecute their good man to the door of the public-house which he is about to enter, when something like shame would restrain him, if stronger misery did not induce him to pass the threshold. That face, ground by want, in which every cheerful, every conversable lineament has been long effaced by misery,—is that a face to stay at home with? Is it more a woman, or a wild cat? Alas! it is the face of the wife of his youth, that once smiled upon him. It can smile no longer. What comforts can it share? what burthens can it lighten? Oh, 'tis fine to talk of the humble meal shared together! But what if there be no bread in the cupboard? The innocent prattle of his children takes the sting out of a man's poverty. But the children of the very poor do not prattle. It is none of the least frightful features in that condition, that there is no childishness in its dwellings. "Poor people," said a sensible old nurse to us once, "do not bring up their children—they drag them up." The little careless darling of the wealthier nursery, in their hovel is transformed betimes into a premature reflecting person. No one has time to dandle it; no one thinks it worth while to coax it, to soothe it, to toss it up and down, to humour it. There is none to kiss away its tears. If it cries, it can only be beaten. It has been prettily said, that a "babe is fed with milk and praise." But the aliment of this poor babe was thin, unnourishing; the return to its little baby tricks and efforts to engage attention, bitter ceaseless objurgation. It never had a toy, or knew what a coral meant. It grew up without the lullaby of nurses; it was a stranger to the patient fondle, the hushing caress, the attracting novelty, the costlier plaything, or the cheaper off-hand contrivance to divert the child, the prattled nonsense (best sense to it), the wise impertinences, the wholesome lies, the apt story interposed that puts a stop to present suffering, and awakens the passions of young wonder. It was never sung to; no one ever told to it a tale of the nursery. It was dragged up, to live or to die as it happened. It had no young dreams. It broke at once into the iron realities of life. A child exists not for the very poor as any object of dalliance; it is only another mouth to be fed—a pair of little hands to be betimes inured to labour. It is the rival, till it can be the co-operator for food with the parent. It is never his mirth, his diversion, his solace—it never makes him young again with recalling his young times. The children of the very poor have no young times. It makes the very heart to bleed to overhear the casual street talk between a poor woman and her little girl—a woman of the better sort of poor, in a condition rather above the squalid beings which we have been contemplating. It is not of toys, of nursery-books, of summer holidays (fitting that age), of the promised sight of plays, of praised sufficiency at school. It is of mangling and clear starching, of the price of coals or potatoes. The questions of the child, that should be the very outpourings of curiosity in idleness, are marked with forecast and melancholy providence. It has come to be a woman before it was a child. It has learned to go to market; it chaffers, it haggles, it envies, it murmurs; it is knowing, acute, sharpened; it never prattles. Had we not reason to say, that the home of the very poor is no home?

THE INSECT OF A DAY.—(FROM THE FRENCH.)

ARISTOTLE says that upon the river Hypanis there exist little animals who live only one day. Those who die at eight o'clock in the morning, die in their youth; those who die at five in the evening, die in a state of decrepitude.

Suppose one of the most robust of these Hypanians as old, according to these nations, as time itself, he would have begun to exist at the break of day, and, through the strength of his constitution, would have been enabled to support an active life during the infinite number of seconds contained in ten or twelve hours. During so long a succession of instants, by his own experience, and by his reflections on all he had seen, he must have acquired great wisdom; he looks upon his fellows who have died at noon as creatures happily delivered from the great number of infirmities to which old age is subject. He may have to relate to his grandsons an astonishing tradition of facts anterior to all the memories of the nation. The young swarm, composed of beings who have lived but an hour, approach the venerable patriarch with respect, and listen with admiration to his instructive discourse. Everything he relates to them appears a prodigy to this generation whose life has been so short. A day appears to them the entire duration of time, and the dawn of day would be called in their chronology the great era of their creation.

Suppose now that the venerable insect, this Nestor of the Hypanis, a short time before his death, about the hour of sunset, assembles all his descendants, his friends, and acquaintances, to give them, with his dying breath, his last advice. They gather from all parts under the vast shelter of a mushroom, and the dying sage addresses them in the following manner:—

"Friends and compatriots, I feel that the longest life must have an end. The term of mine has arrived, and I do not regret my fate, since my great age has become a burden to me, and there is nothing new under the sun for me. The revolutions and calamities that have desolated my country, the great number of particular accidents to which we are all subject, the infirmities that afflict our species, and the misfortunes that have happened in my own family, all that I have seen in the course of a long life, has only too well taught me this great truth, that happiness placed in things that do not depend upon ourselves can never be certain and lasting. An entire generation has perished by a violent wind, a multitude of our imprudent youth have been swept into the water by a brisk and unexpected breeze. What terrible floods a sudden rain has caused! Our firmest shelters even are not proof again a hail-storm. A dark cloud causes even the most courageous hearts to tremble.

"I lived in the early ages, and conversed with insects of larger growth, of stronger constitutions, and I may say of greater wisdom, than any of the present generation. I conjure you to give credit to my last words, when I assure you that the sun which now appears beyond the water, and which seems not far from the earth, I have seen in times past fixed in the middle of the heavens, its rays darting directly upon us. The earth was much lighter in past ages, the air was much warmer, and our ancestors were more sober and more virtuous.

"Although my senses are enfeebled, my memory is not; I can assure you that this glorious luminary moves. I have seen it rising over the summit of that mountain, and I began my life about the time that it commenced its immense career. It has, during several centuries, advanced in the heavens with an astonishing heat and brilliancy, of which you can have no idea, and which assuredly you could not have supported; but now by its decline, and the sensible diminution of its vigour, I foresee that all nature must shortly terminate, and that this world will be buried in darkness in less than a hundred minutes.

"Alas! my friends, how I flattered myself at one time with the deceitful hope of always living on this earth! how magnificent were the cells I had hollowed out for myself! what confidence did I put in the firmness of my limbs, and in the elasticity of their joints, and in the strength of my wings! But I have lived long enough for nature and for glory, and none of those I leave behind me will have the same satisfaction in the century of darkness and decay that I see about to begin."

Contentment and Thankfulness.—(Izaak Walton.)
Abridged.

I will, as we walk in the cool shade of the sweet honeysuckle hedge, mention to you some of the thoughts and joys which have possessed my soul since we two met together. And these thoughts shall be told you, that you also may join with me in thankfulness to the Giver of every good and perfect gift for our happiness. And that our present happiness may appear to be the greater, and we the more thankful for it, I will beg you to consider with me how many do even at this very time lie under the torment of diseases that we are free from. And every misery that I miss is a new mercy, and therefore let us be thankful. There have been, since we met, others that have met disasters of broken limbs; some have been blasted, others thunderstricken; and we have been freed from these and all those other miseries that threaten human nature; let us therefore rejoice and be thankful. Nay, which is a far greater mercy, we are freed from the insupportable burden of an accusing tormenting conscience—a misery that none can bear; and, therefore, let us praise Him for his preventing grace, and say every misery that I miss is a new mercy. Nay, let me tell you, there be many that have forty times our estate, that would give the greater part of it to be healthful and cheerful like us. I have a rich neighbour who is always so busy that he has no leisure to laugh. The whole business of his life is to get money and more money; that he may still get more and more money, he is still drudging on, and says that Solomon says, "The diligent hand maketh rich;" and it is true indeed: but he considers not that it is not in the power of riches to make a man happy, for it was wisely said by a man of great observation, "that there be as many miseries *beyond* riches as on this side of them." And yet God deliver us from pinching poverty, and grant that, having a competency, we may be content and thankful. Let us not repine, or so much as think the gifts of God unequally dealt, if we see another abound with riches; when, as God knows, the cares that are the keys that keep those riches hang often so heavily at the rich man's girdle, that they clog him with weary days and restless nights even when others sleep quietly. We see but the outside of the rich man's happiness; few consider him to be like the silkworm, that when she seems to play, is at the very same time spinning her own bowels, and consuming herself; and this many rich men do, loading themselves with corroding cares to keep what they have probably unconsciously got. Let us therefore be thankful for health and a competence, and above all, for a quiet conscience.

Nature is content with a little, and yet you shall hardly meet with a man that complains not of some want. I know a man that had health and riches, and several houses all beautiful and ready furnished, and would often trouble himself and family to be removing from one house to another; and being asked by a friend why he removed so often from one house to another, replied, "It was to find content in some one of them." But his friend, knowing his temper, told him if he would find content in any of his houses, he must leave himself behind him, for content will never dwell but in a meek and quiet soul. And this may appear if we read and consider what our Saviour says in St. Matthew's gospel. for He there says, "Blessed are the merciful, for they shall obtain mercy. Blessed be the pure in heart, for they shall see God. And blessed be the meek, for they shall possess the earth." Not that the meek shall not also obtain mercy, and see God, and be comforted, and at last come to the kingdom of heaven; but in the meantime, he, and he only, possesses the earth, as he goes towards that kingdom of heaven, by being humble, and cheerful, and content with what his good God has allotted him. He has no turbulent, repining, vexatious thoughts that he deserves better, nor is vexed when he sees others possessed of more honour or more riches than his wise God has allotted for his share; but he possesses what he has with a meek and contented quietness—such a quietness as makes his very dreams pleasing both to God and to himself. I have heard a grave divine say that God has two dwellings, one in heaven, and the other in a meek and thankful heart, which Almighty God grant to me and to you.

A Rill from the Town Pump.[1]—(N. Hawthorne.)

Noon by the north clock! Noon by the east! High noon, too, by these hot sunbeams, which fall, scarcely aslope, upon my

[1] Scene—The corner of two principal streets. (Essex and Washington Streets, Salem.) The Town-Pump talking through its nose.

head, and almost make the water bubble and smoke in the troughs under my nose. Truly, we public characters have a tough time of it! And, among all the town-officers, chosen at March meeting, where is he that sustains, for a single year, the burthen of such manifold duties as are imposed, in perpetuity, upon the Town-Pump? The title of "town treasurer" is rightfully mine, as guardian of the best treasure that the town has. The overseers of the poor ought to make me their chairman, since I provide bountifully for the pauper without expense to him that pays taxes. I am at the head of the fire department, and one of the physicians to the board of health. As a keeper of the peace all water-drinkers will confess me equal to the constable. I perform some of the duties of the town-clerk, by promulgating public notices when they are posted on my front. To speak within bounds, I am the chief person of the municipality, and exhibit, moreover, an admirable pattern to my brother officers, by the cool, steady, upright, downright, and impartial discharge of my business, and the constancy with which I stand to my post. Summer or winter, nobody seeks me in vain, for all day long I am seen at the busiest corner, just above the market, stretching out my arms to rich and poor alike; and at night I hold a lantern over my head, both to show where I am and keep people out of the gutters.

At this sultry noontide, I am cupbearer to the parched populace, for whose benefit an iron goblet is chained to my waist. Like a dram-seller on the mall, at muster-day, I cry aloud to all and sundry, in my plainest accents, and at the very tiptop of my voice,—Here it is, gentlemen! Here is the good liquor! Walk up, walk up, gentlemen, walk up, walk up! Here is the superior stuff! Here is the unadulterated ale of father Adam—better than Cognac, Hollands, Jamaica, strong beer, or wine of any price; here it is, by the hogshead or the single glass, and not a cent to pay! Walk up, gentlemen, walk up and help yourselves!

It were a pity if all this outcry should draw no customers. Here they come. A hot day, gentlemen! Quaff, and away again, so as to keep yourselves in a nice cool sweat. You, my friend, will need another cupful, to wash the dust out of your throat, if it be as thick there as it is on your cowhide shoes. I see that you have trudged half-a-score of miles to-day, and, like a wise man, have passed by the taverns, and stopped at the running brooks and well-curbs. Otherwise, betwixt heat without and fire within, you would have been burnt to a cinder, or melted down to nothing at all, in the fashion of a jelly-fish. Drink, and make room for that other fellow, who seeks my aid to quench the fiery fever of last night's potations, which he drained from no cup of mine. Welcome, most rubicund sir! You and I have been great strangers, hitherto; nor, to confess the truth, will my nose be anxious for a closer intimacy, till the fumes of your breath be a little less potent. Mercy on you, man! the water absolutely hisses down your red-hot gullet, and is converted quite to steam, in the miniature Tophet, which you mistake for a stomach. Fill again, and tell me, on the word of an honest toper, did you ever, in cellar, tavern, or any kind of dram-shop spend the price of your children's food, for a swig half so delicious? Now, for the first time these ten years, you know the flavour of cold water. Good-by; and, whenever you are thirsty, remember that I keep a constant supply at the old stand. Who next? Oh, my little friend, you are let loose from school, and come hither to scrub your blooming face, and drown the memory of certain taps of the ferule, and other schoolboy troubles, in a draught from the Town Pump. Take it, pure as the current of your young life. Take it, and may your heart and tongue never be scorched with a fiercer thirst than now! There, my dear child, put down the cup, and yield your place to this elderly gentleman, who treads so tenderly over the paving-stones, that I suspect he is afraid of breaking them. What! he limps by, without so much as thanking me, as if my hospitable offers were meant only for people who have no wine-cellars. Well, well, sir; no harm done, I hope! Go draw the cork, tip the decanter; but, when your great toe sets you a-roaring, it will be no affair of mine. If gentlemen love the pleasant titillation of the gout, it is all one to the Town Pump. This thirsty dog, with his red tongue lolling out, does not scorn my hospitality, but stands on his hind legs and laps eagerly out of the trough. See how lightly he capers away again! Jowler, did your worship ever have the gout?

Are you all satisfied? Then wipe your mouths, my good friends; and, while my spout has a moment's leisure, I will delight the town with a few historical reminiscences. In far antiquity, beneath a darksome shadow of venerable boughs, a spring bubbled out of the leaf-strewn earth, in the very spot where you now behold me, on the sunny pavement. The water was as bright and clear, and deemed as precious, as liquid diamonds. The Indian sagamores drank of it from time immemorial, till the fatal deluge of the fire-water burst upon the red men, and swept their whole race away from the cold fountains. Endicott and his followers came next, and often knelt down to drink, dipping their long beards in the spring. The richest goblet, then, was of birch bark. Governor Winthrop, after a journey afoot from Boston, drank here, out of the hollow of his hand. The elder Higginson here wet his palm, and laid it on the brow of the first town-born child. For many years it was the watering-place, and, as it were, the washbowl of the vicinity—whither all decent folks resorted, to purify their visages, and gaze at them afterwards—at least the pretty maidens did—in the mirror which it made. On Sabbath days, whenever a babe was to be baptized, the sexton filled his basin here, and placed it on the communion-table of the humble meeting-house, which partly covered the site of yonder stately brick one. Thus one generation after another was consecrated to Heaven by its waters, and cast their waxing and waning shadows into its glassy bosom, and vanished from the earth, as if mortal life were but a flitting image in a fountain. Finally, the fountain vanished also. Cellars were dug on all sides, and cart-loads of gravel flung upon its source, whence oozed a turbid stream, forming a mud-puddle at the corner of two streets. In the hot months, when its refreshment was most needed, the dust flew in clouds over the forgotten birthplace of the waters, now their grave. But in the course of time, a Town Pump was sunk into the source of the ancient spring; and when the first decayed, another took its place, and then another, and still another, till here stand I, gentlemen and ladies, to serve you with my iron goblet. Drink and be refreshed! The water is as pure and cold as that which slaked the thirst of the red sagamore, beneath the aged boughs, though now the gem of the wilderness is treasured under these hot stones, where no shadow falls but from the brick buildings. And be it the moral of my story, that as this wasted and long-lost fountain is now known and prized again, so shall the virtues of cold water, too little valued since your father's days, be recognised by all.

Your pardon, good people! I must interrupt my stream of eloquence, and spout forth another stream of water, to replenish the trough for this teamster and his two yoke of oxen, who have come from Topsfield, or somewhere along that way. No part of my business is pleasanter than the watering of cattle. Look! how rapidly they lower the watermark on the sides of the trough, till their capacious stomachs are moistened with a gallon or two a-piece, and they can afford time to breathe it in, with sighs of calm enjoyment. Now they roll their quiet eyes around the brim of their monstrous drinking-vessel. An ox is your true toper.

But I perceive, my dear auditors, that you are impatient for the remainder of my discourse. Impute it, I beseech you, to no defect of modesty, if I insist a little longer on so fruitful a topic as my own multifarious merits. It is altogether for your good. The better you think of me, the better men and women will you find yourselves. I shall say nothing of my all-important aid on washing-days, though on that account alone I might call myself the household god of a hundred families. Far be it from me also to hint, my respectable friends, at the show of dirty faces which you would present without my pains to keep you clean. Nor will I remind you how often, when the midnight bells make you tremble for your combustible town, you have fled to the Town Pump, and found me always at my post, firm amid the confusion, and ready to drain my vital current in your behalf. Neither is it worth while to lay much stress on my claims to a medical diploma —as the physician whose simple rule of practice is preferable to all the nauseous lore, which has found men sick or left them so, since the days of Hippocrates. Let us take a broader view of my beneficial influence on mankind.

No; these are trifles compared with the merits which wise men concede to me—if not in my single self, yet as representative of a class—of being the grand reformer of the age. From my spout, and such spouts as mine, must flow the stream that shall cleanse our earth of the vast portion of its crime and anguish, which has gushed from the fiery fountains of the still. In this mighty enterprise the cow shall be my great confederate. Milk and water? The Town Pump and the Cow! Such is the glorious copartnership that shall tear down the distilleries and brewhouses, uproot the vineyards, shatter the cider-presses, ruin the tea and coffee trade, and finally monopolize the whole business of quenching thirst. Blessed consummation! Then Poverty shall pass away from the land, finding no hovel so wretched where her squalid form may shelter itself. Then Disease, for lack of other victims, shall gnaw its own heart and die. Then Sin, if she do not die, shall lose half her strength. Until now the phrensy of hereditary fever has raged in the human blood, transmitted from sire to son, and rekindled in every generation, by fresh draughts of liquid flame. When that inward fire shall be extinguished, the heat of passion cannot but grow cool, and war—the drunkenness of nations—perhaps will cease. At least there will be no war of households. The husband and wife, drinking deep of peaceful joy—a calm bliss of temperate affections—shall pass hand in hand through life, and lie down, not reluctantly, at its protracted close. To them the past will be no turmoil of mad dreams, nor the future an eternity of such moments as follow the delirium of the drunkard. Their dead faces shall express what their spirits were, and are to be, by a lingering smile of memory and hope.

Ahem! Dry work, this speechifying; especially to an unpractised orator. I never conceived till now what toil the temperance lecturers undergo for my sake. Hereafter they shall have the business to themselves. Do, some kind Christian, pump a stroke or two, just to wet my whistle. Thank you, sir! My dear hearers, when the world shall have been regenerated by my instrumentality, you will collect your useless vats and liquor-casks into one great pile, and make a bonfire in honour of the Town Pump. And when I shall have decayed, like my predecessors, then, if you revere my memory, let a marble fountain, richly sculptured, take my place upon this spot. Such monuments should be erected everywhere, and inscribed with the names of the distinguished champions of my cause. Now listen; for something very important is to come next.

There are two or three honest friends of mine—and true friends I know they are—who, nevertheless, by their fiery pugnacity in my behalf, do put me in fearful hazard of a broken nose, or even a total overthrow upon the pavement, and the loss of the treasure which I guard. I pray you, gentlemen, let this fault be amended. Is it decent, think you, to get tipsy with zeal for temperance, and take up the honourable cause of the Town Pump, in the style of a toper fighting for his brandy bottle? Or, can the excellent qualities of cold water be not otherwise exemplified than by plunging, slapdash, into hot water, and wofully scalding yourselves and other people ? Trust me, they may. In the moral warfare which you are to wage—and indeed in the whole conduct of your lives —you cannot choose a better example than myself, who have never permitted the dust and sultry atmosphere, the turbulence and manifold disquietudes of the world around me, to reach that deep, calm well of purity, which may be called my soul. And whenever I pour out that soul, it is to cool earth's fever, or cleanse its stains.

One o'clock ! Nay, then, if the dinner-bell begins to speak, I may as well hold my peace. Here comes a pretty young girl of my acquaintance with a large stone pitcher for me to fill. May she draw a husband while drawing her water, as Rachel did of old. Hold out your vessel, my dear ! There it is, full to the brim ; so now run home, peeping at your sweet image in the pitcher as you go ; and forget not, in a glass of my own liquor, to drink—" SUCCESS TO THE TOWN PUMP !"

THE ATMOSPHERE.—(QUARTERLY REVIEW.)

THE atmosphere rises above us with its cathedral dome arching towards the heavens, of which it is the most familiar synonyme and symbol. It floats around us like that grand object which the apostle John saw in his vision—" a sea of glass like unto crystal." So massive is it, that when it begins to stir, it tosses about great ships like playthings, and sweeps cities and forests to destruction before it. And yet it is so mobile, that we have lived years in it before we can be persuaded that it exists at all, and the great bulk of mankind never realize the truth that they are bathed in an ocean of air. Its weight is so enormous that iron shivers before it like glass, yet a soap-bubble sails through it with impunity, and the tiniest insect waves it aside with its wing.

It ministers lavishly to all the senses. We touch it not, but it touches us. Its warm south wind brings back colour to the pale face of the invalid ; its cool west winds refresh the fevered brow, and make the blood mantle in our cheeks ; even its north blasts brace into new vigour the hardy children of our rugged clime.

The eye is indebted to it for all the magnificence of sunrise, the full brightness of midday, the chastened radiance of the "gloamin," and the "clouds that cradle near the setting sun." But for it the rainbow would want its "triumphal arch," and the winds would not send their fleecy messengers on errands round the heavens. The cold weather would not shed its snow feathers on the earth, nor would drops of dew gather on the flowers. The kindly rain would never fall, nor hail, storm, nor fog, diversify the face of the sky. Our naked globe would turn its tanned and unshadowed forehead to the sun, and one dreary, monotonous blaze of light and heat dazzle and burn up all things.

Were there no atmosphere, the evening sun would in a moment set, and without warning plunge the earth in darkness. But the air keeps in her hand a sheaf of his rays, and lets them slip slowly through her fingers; so that the shadows of evening gather by degrees, and the flowers have time to bow their heads, and each creature space to find a place of rest and nestle to repose. In the morning the garish sun would at once burst from the bosom of night and blaze above the horizon, but the air watches for his coming, and sends at first one little ray to announce his approach, and then another, and by and by a handful; and so gently draws aside the curtain of night, and slowly lets the light fall on the face of the sleeping earth, till her eyelids open, and like man, she "goeth forth again to her labour till the evening."

The Wonders of Nature.—(Sir Thomas Browne.*)

I could never content my contemplation with those general pieces of wonder, the flux and reflux of the sea, the increase of the Nile, the conversion of the needle to the north; and I have studied to match and parallel these in the more obvious and neglected pieces of nature, which without further travel, I can do in the cosmography of myself. We carry with us the wonders we seek without us; there is all Africa and her prodigies in us. We are that bold and adventurous piece of nature which he that studies wisely learns in a compendium, what others labour at in a divided piece and endless volume.

Thus there are two books from whence I collect my divinity. Besides that written one of God, another of His servant Nature,

* Died 1682.

that universal and public manuscript that lies exposed unto the eyes of all. Those that never saw Him in the one have discovered Him in the other; this was the scripture and theology of the heathens; the natural motion of the sun made them more admire Him, than its supernatural station[1] did the children of Israel. The ordinary effects of nature wrought more admiration in them than did in the other all His miracles. Surely the heathens knew better how to join and read these mystical letters than we Christians, who cast a more careless eye on those common hieroglyphics, and disdain to suck divinity from the flowers of nature. Nor do I so forget God as to adore the name of Nature; which I define

King of Portugal, to whom he subsequently applied, could be persuaded to enter into his views. The King of Portugal was, indeed, dishonourable enough, while rejecting Columbus's proposal, to send out a vessel of his own secretly to try the route marked out by the Italian. But its unskilful commander was soon frightened back again by the difficulties he encountered, and the discovery of this treachery sent the indignant Columbus at once to Spain, to unfold his scheme to Ferdinand and Isabella, who jointly reigned over Castile and Aragon, while, at the same time, his brother Bartholomew was despatched to England to lay it before Henry VII.

It was by mere accident that the English had not the glory and advantage of the illustrious navigator's discoveries. Henry received the proposal more favourably than any other monarch had done; but Bartholomew had been captured by pirates on his voyage to England, and by the time he arrived there, his brother, after years of suspense and disappointment, had at last succeeded in procuring the assistance and protection of Ferdinand and Isabella.

Three small and ill-conditioned vessels, with provisions for twelve

the actions of their inward forms, and having passed that general visitation of God, who saw that all that He had made was good, that is, conformable to His will, which abhors deformity, and is the will of order and beauty. There is no deformity but in monstrosity; wherein, notwithstanding, there is a kind of beauty, nature so ingeniously contriving the irregular parts, as they become sometimes more remarkable than the principal fabric. To speak yet more narrowly, there was never anything ugly or misshapen

[1] In the literal sense of "standing still."

but the chaos; wherein, notwithstanding, to speak strictly, there was no deformity, because no form, nor was it yet impregnate by the voice of God. Now nature is not at variance with art, nor art with nature, they being both the servants of His providence. Art is the perfection of nature. Were the world now as it was the sixth day, there were yet a chaos. Nature hath made one world and art another. In brief, all things are artificial, for nature is the art of God.

The Life of Christopher Columbus.

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In 1470, having married the daughter of a Portuguese sea-captain, Columbus settled at Lisbon. Portugal was at that time the greatest maritime nation of Europe, and Columbus made diligent use of the opportunities which his residence and connexions there afforded him for improving his knowledge both of the theory and practice of navigation. He was soon deeply interested in a subject at that time of considerable importance—the discovery of a shorter sea route to India than that round the Cape of Good Hope. That passage was not accomplished till some years after; but at the period now referred to, it was believed to be practicable, though its extreme length and the storms that had beset seamen in rounding the Cape—it was called the Cape of Storms—rendered it very formidable to the imperfect seamanship of that day.

A variety of reasons led Columbus to believe, that, by sailing westward from Europe, he should in due time reach the eastern shores of Asia; and, having well considered his plans, he sought the assistance needful for such an enterprise from his own native city of Genoa, which he was patriotic enough to wish should have the benefit of his undertaking. But neither its rulers, nor the King of Portugal, to whom he subsequently applied, could be persuaded to enter into his views. The King of Portugal was, indeed, dishonourable enough, while rejecting Columbus's proposal, to send out a vessel of his own secretly to try the route marked out by the Italian. But its unskilful commander was soon frightened back again by the difficulties he encountered, and the discovery of this treachery sent the indignant Columbus at once to Spain, to unfold his scheme to Ferdinand and Isabella, who jointly reigned over Castile and Aragon, while, at the same time, his brother Bartholomew was despatched to England to lay it before Henry VII.

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Three small and ill-conditioned vessels, with provisions for twelve months, were given to Columbus by these monarchs. With that religious spirit which always distinguished this good man, he and all his crew solemnly joined in prayers and the holy communion before going on board; and then, just before daybreak on the 3d of August 1492, he set sail from Palos, in Andalusia, amid the prayers and good wishes of a vast throng of spectators. His little fleet was steered first to the Canary Islands, and in that short distance it was found that his miserable vessels were utterly unfit for the voyage before them. One of them lost her rudder the very day after leaving port. Columbus made such repairs as he could, took in fresh provisions at the Canaries, where he remained about three weeks, and then directed his course still westward, into the unknown ocean.

His crew were soon disheartened, and it required all their leader's patience, skill, and vigilance, to keep them to their duty. He dared not even let them know how far they had sailed, for fear of their losing courage altogether. When distant six or seven hundred miles from shore, Columbus noticed for the first time the variations of the magnetic needle. He strove in vain to conceal it from his crew, who were terror-struck at the thought that their compass was about to fail them in that trackless waste of waters; but Columbus calmed their fears by an ingenious theory, which, however, was far from satisfying his own mind.

In alternations of hope and fear they sailed on. Now a favourable wind, or the appearance of land birds, filled them with delight—now their vessel was impeded by weeds, or the sight of a half-decayed mast troubled them with forebodings of their own probable fate. One day the gentle breeze that wafted them onward was hailed as a friend, the next they were dismayed by the thought that it always blew from the same quarter, and would never permit them to return to Spain. One spirit alone remained to outward appearance calm and confident. No natural phenomenon, however startling, no sickness of "hope deferred," no threats or entreaties of his crew, could touch the serenity of Columbus, or turn him for a single moment from the glorious object he had in view. At last the crews began to speak of sailing homeward in spite of their admiral, and threatened open mutiny. It was only then that, convinced by many signs of the near approach of land, their noble commander promised, if in three days his hopes were not realized, he would yield to their wishes and return to Spain.

On the event of these three days, then, hung the fate of that wonderful enterprise. It is impossible to imagine a situation more exciting than that of Columbus as these days passed by and yet no land appeared, or to realize the mournful feelings with which he beheld the sun sink down each night, its last golden beam reflected still on the wide Atlantic waters.

COLUMBUS—*Continued.*—(WASHINGTON IRVING.)

AND when, on the evening of the third day, they beheld the sun go down upon the shoreless horizon, they broke forth into clamorous turbulence. Fortunately, however, the manifestations of neighbouring land were such on the following day as no longer to admit of doubt. Besides a quantity of fresh weeds, such as grow in rivers, they saw a green fish of a kind which keeps about rocks; then a branch of thorn with berries on it, and recently separated from the tree, floated by them; then they picked up a reed, a small board, and, above all, a staff artificially carved. All gloom and mutiny now gave way to sanguine expectation; and throughout the day each one was eagerly on the watch, in hopes of being the first to discover the long-sought-for land.

In the evening, when, according to invariable custom on board of the admiral's ship, the mariners had sung the *Salve Regina*, or vesper hymn to the Virgin, he made an impressive address to his crew. He pointed out the goodness of God in thus conducting them by such soft and favouring breezes across a tranquil ocean, cheering their hopes continually with fresh signs, increasing as their fears augmented, and thus leading and guiding them to a promised land.

The breeze had been fresh all day, with more sea than usual, and they had made great progress. At sunset they had stood again to the west, and were ploughing the waves at a rapid rate, the Vinta keeping the lead from her superior sailing. The greatest animation prevailed throughout the ships; not an eye was closed that night. As the evening darkened, Columbus took his station on the top of the castle or cabin on the high poop of his vessel. However he might carry a cheerful or confident countenance during the day, it was to him a time of the most painful anxiety; and now, when he was wrapped from observation by the shades of night, he maintained an intense and unremitting watch, ranging his eye along the dusky horizon in search of the most vague indications of land. Suddenly, about ten o'clock he thought he beheld a light glimmering at a distance! Fearing that his eager hopes might deceive him, he called to Pedro Gutierrery, gentleman of the king's bedchamber, and inquired whether he saw a light in that direction; the latter replied in the affirmative.

Columbus, yet doubtful whether it might not be some delusion of the fancy, called Roderigo Sanchery of Segovia, and made the same inquiry. By the time the latter had ascended the round-house the light had disappeared. They saw it once or twice afterwards, in sudden and passing gleams, as it were a torch in the bark of a fisherman, rising and sinking with the waves, or in the hand of some person on shore, borne up and down as he walked from house to house. So transient and uncertain were these gleams that few attached any importance to them—Columbus, however, considering them as certain signs of land, and, moreover, that the land was inhabited.

They continued their course until two in the morning, when a gun from the Vinta gave the joyful signal of land. It was first discovered by a mariner named Rodrigo de Triano, but the reward was afterwards adjudged to the admiral for having previously perceived the light. The land was now clearly seen about two leagues distant; whereupon they took in sail and lay to, waiting impatiently for the dawn.

The thoughts and feelings of Columbus in this little space of time must have been tumultuous and intense. At length, in spite of every difficulty and danger, he had accomplished his object. The great mystery of the ocean was revealed; his theory, which had been the scoff of sages, was triumphantly established; he had secured to himself a glory which must be as durable as the world itself.

It is difficult even for the imagination to conceive the feelings of such a man at the moment of so sublime a discovery. What a bewildering crowd of conjectures must have thronged upon his mind as to the land which lay before him covered with darkness. That it was fruitful was evident from the vegetables which floated from its shores. He thought, too, that he perceived in the balmy air the fragrance of aromatic groves. The moving light which he had beheld, had proved it the residence of man. But what were its inhabitants? Were they like those of the other parts of the globe? or were they some strange and monstrous race, such as the imagination in those times was prone to give to all remote and unknown regions? Had he come upon some wild island far in the Indian Sea? or was this the famed Cipango itself, the object of his golden fancies? A thousand speculations of the kind must have swarmed upon him, as, with his anxious crews he waited for the night to pass away, wondering whether the morning light would reveal a savage wilderness, or dawn upon spicy groves and glittering fanes, and gilded cities, and all the splendour of oriental civilisation.

Return and Reception of Columbus.—(Prescott.)

In the spring of 1493, while the court was still at Barcelona, letters were received from Christopher Columbus, announcing his return to Spain, and the successful achievement of his great enterprise, by the discovery of land beyond the western ocean. The delight and astonishment raised by this intelligence were proportioned to the scepticism with which his project had originally been viewed. The sovereigns were now filled with a natural impatience to ascertain the extent and other particulars of the important discovery; and they transmitted instant instructions to the admiral to repair to Barcelona, as soon as he should have made the preliminary arrangements for the further prosecution of his enterprise.

The great navigator had succeeded, as is well known, after a voyage of natural difficulties, difficulties which had been much augmented by the distrust and mutinous spirit of his followers, in descrying land on the 12th of October 1492. After some months spent in exploring the delightful regions, now for the first time thrown open to the eyes of an European, he embarked in the year 1493 for Spain. One of his vessels had previously foundered, and another had deserted him; so that he was left alone to retrace his course across the Atlantic. After a most tempestuous voyage, he was compelled to take shelter in the Tagus, sorely against his inclination. He experienced, however, a most honourable reception from the Portuguese monarch, John II., who did ample justice to the great qualities of Columbus, although he had failed to profit by them. After a brief delay, the admiral resumed his voyage, and crossing the bar of Saltes, entered the harbour of Palos about noon, on the 15th of March 1493, being exactly seven months and eleven days since his departure from that port.

Great was the commotion in the little community of Palos, as they beheld the well-known vessel of the admiral re-entering their harbour. Their desponding imaginations had long since consigned him to a watery grave; for, in addition to the preternatural horrors which hung over the voyage, they had experienced the most stormy and disastrous winter within the recollection of the oldest mariners. Most of them had relatives or friends on board. They thronged immediately to the shore, to assure themselves, with their own eyes, of the truth of their return. When they beheld their faces once more, and saw them accompanied by the numerous evidences which they brought back of the success of the expedition, they burst forth in acclamations of joy and gratulation. They awaited the landing of Columbus, and the whole population of the place accompanied him and his crew to the principal church, where solemn thanksgivings were offered up for their return; while every bell in the village sent forth a joyous peal in honour of the happy event.

The admiral was too desirous of presenting himself before the sovereigns to protract his stay long at Palos. He took with him on his journey specimens of the multifarious products of the newly-discovered regions. He was accompanied by several of the native islanders, arrayed in their simple barbaric costume, and decorated, as he passed through the principal cities, with collars, bracelets, and other ornaments of gold, rudely fashioned; he exhibited also considerable quantities of the same metal in dust or in crude masses, numerous vegetable exotics possessed of aromatic or medicinal virtue, and several kinds of quadrupeds unknown in Europe, and birds, whose variety of gaudy plumage gave a brilliant effect to the pageant. The admiral's progress through the country was everywhere impeded by the multitudes thronging forth to gaze at the extraordinary spectacle, and the more extraordinary man, who, in the emphatic language of that time, which has now lost its force from familiarity, first revealed the existence of a "New World." As he passed through the busy, populous city of Seville, every window, balcony, and housetop which could afford a glimpse of him is described to have been crowded with spectators.

It was the middle of April before Columbus reached Barcelona. The nobility and cavaliers in attendance on the court, together with the authorities of the city, came to the gates to receive him, and escorted him to the royal presence. Ferdinand and Isabella were seated, with their son, Prince John, under a superb canopy of state, awaiting his arrival. On his approach they rose from their seats, and extending their hands to him to salute, caused him to be seated before them. These were unprecedented marks of condescension, to a person of Columbus's rank, in the haughty and ceremonious court of Castile. It was, indeed, the proudest moment in the life of Columbus. He had fully established the truth of his long-contested theory, in the face of argument, sophistry, sneer, scepticism, and contempt. He had achieved this not by chance, but by calculation, supported through the most adverse circumstances by consummate conduct. The honours paid him, which had hitherto been reserved only for rank, or fortune, or military success, purchased by the blood and tears of thousands, were in his case a homage to intellectual power successfully exerted in behalf of the noblest interests of humanity.

After a brief interval, the sovereigns requested of Columbus a recital of his adventures. His manner was sedate and dignified, but warmed by the glow of natural enthusiasm. He enumerated the several islands he had visited, expatiated on the temperate character of the climate, and the capacity of the soil for every variety of production, appealing to the samples imported by him as evidence of their natural productiveness. He dwelt more at large on the precious metals to be found in these islands, which he inferred less from the specimens actually obtained than from the uniform testimony of the natives to their abundance in the unexplored regions of the interior. Lastly, he pointed out the wide scope afforded to Christian zeal in the illumination of a race of men whose minds, far from being wedded to any system of idolatry, were prepared by their extreme simplicity for the reception of pure and uncorrupted doctrine. The last consideration touched Isabella's heart most sensibly; and the whole audience, kindled with various emotions by the speaker's eloquence, filled up the perspective with the gorgeous colouring of their own fancies, as ambition, or avarice, or devotional feeling, predominated in their bosoms. When Columbus ceased, the king and queen, together with all present, prostrated themselves on their knees in grateful thanksgivings, while the solemn strains of the Te Deum were poured forth by the choir of the royal chapel, as in commemoration of some glorious victory.

Religion in Common Life.—(Caird.)

The salvation which the Gospel offers is not the prize of a lofty intellect, but of a lowly heart. The mirror in which its grand truths are reflected is not a mind of calm and philosophic abstraction, but a heart of earnest purity. Its light shines best and fullest, not on a life undisturbed by business, but on a soul unstained by sin. The religion of Christ, whilst it affords scope for the loftiest intellect in the contemplation and development of its glorious truths, is yet, in the exquisite simplicity of its essential facts and principles, patent to the simplest mind. Rude, untutored, toil-worn you may be, but if you have wit enough to guide you in the commonest round of daily toil, you have wit enough to learn the way to be saved. The truth as it is in Jesus, whilst, in one view of it, so profound that the highest archangel's intellect may be lost in the contemplation of its mysterious depths, is yet, in another, so simple that the lisping babe at a mother's knee may learn its meaning.

Again: View religion as an *Art*, and, in this light too, its compatibility with a busy and active life in the world, it will not be difficult to perceive. For religion as an art differs from secular arts in this respect, that it may be practised simultaneously with other arts—with all other work and occupation in which we may be engaged. A man cannot be studying architecture and law at the same time. The medical practitioner cannot be engaged with his patients, and at the same time planning houses or building bridges,—practising, in other words, both medicine and engineering at one and the same moment. The practice of one secular art excludes for the time the practice of other secular arts. But not so with the art of religion. This is the universal art, the common, all-embracing profession. It belongs to no one set of functionaries, to no special class of men. Statesman, soldier, lawyer, physician, poet, painter, tradesman, farmer—men of every craft and calling in life—may, while in the actual discharge of the duties of their varied avocations, be yet, at the same moment, discharging the duties of a higher and nobler vocation—practising the art of a Christian. Secular arts, in most cases, demand of him who would attain to eminence in any of them, an almost exclusive devotion of time, and thought, and toil. The most versatile genius can seldom be master of more than one art; and for the great majority the only calling must be that by which they earn their daily bread. Demand of the poor tradesman or peasant, whose every hour is absorbed in the struggle to earn a competency for himself and his family, that he shall be also a thorough proficient in the art of the physician, or lawyer, or sculptor, and you demand an impossibility. If religion were an art such as these, few indeed could learn it. The two admonitions, "Be diligent in business," and "Be fervent in spirit, serving the Lord," would be reciprocally destructive.

But religion is no such art; for it is the *art of being, and of doing, good:* to be an adept in it, is to become just, truthful, sincere, self-denying, gentle, forbearing, pure in word, and thought, and deed. And the school for learning this art is, not the closet, but the world,—not some hallowed spot where religion is taught, and proficients, when duly trained, are sent forth into the world, —but the world itself, the coarse, profane, common world, with its cares and temptations, its rivalries and competitions, its hourly, ever-recurring trials of temper and character. This is, therefore, an art which all can practise, and for which every profession and calling, the busiest and most absorbing, afford scope and discipline. When a child is learning to write, it matters not of what words the copy set to him is composed, the thing desired being that, whatever he writes, he learn to write *well.* When a man is learning to be a Christian, it matters not what his particular work in life may be; the work he does is but the copy-line set to him, the main thing to be considered is that he learn to live well. The form is nothing, the execution is everything. It is true indeed that prayer, holy reading, meditation, the solemnities and services of the Church, are necessary to religion, and that these can be practised only apart from the work of secular life. But it is to be remembered that all such holy exercises do not terminate in themselves. They are but steps in the ladder to heaven, good only as they help us to climb. They are the irrigation and enriching of the spiritual soil, worse than useless if the crop become not more abundant. They are, in short, but means to an end; good only in so far as they help us to be good and to do good, to glorify God and do good to man; and that end can perhaps best be attained by him whose life is a busy one, whose avocations bear him daily into contact with his fellows, into the intercourse of society, into the heart of the world. . . . Never, in the highest and holiest sense, can any one become a *religious man*, until he has acquired those habits of daily self-denial, of resistance to temptation, of kindness, gentleness, humility, sympathy, active beneficence, which are to be acquired only in daily contact with mankind. Tell us not, then, that the man of business, the bustling tradesman, the toil-worn labourer, has little or no time to attend to religion. As well tell us that the pilot, amid the winds and storms, has no leisure to attend to navigation, or the general, on the field of battle, to the art of war! Where *will* he attend to it? Religion is not a perpetual moping over good books—religion is not even prayer, praise, holy ordinances. These are necessary to religion—no man can be religious without them. But religion, I repeat, is mainly and chiefly the glorifying God amid the duties and trials of the world; the guiding our course amid the adverse winds and currents of temptation, by the starlight of duty and the compass of divine truth; the bearing us manfully, wisely, courageously, for the honour of Christ, our great leader in the conflict of life. Away then with the notion that ministers and devotees may be religious, but that a religious and holy life is impracticable in the rough and busy world! Nay rather, believe me, *that* is the proper scene, the peculiar and appropriate field for religion—the place in which to prove that piety is not a dream of Sundays and solitary hours; that it can bear the light of day; that it can wear well amid the rough jostlings, the hard struggles, the coarse contacts of common life—the place, in one word, to prove how possible it is for a man to be at once "not slothful in business," and "fervent in spirit, serving the Lord." . . .

Again, carry holy principles with you into the world, and the world will become hallowed by their presence. A Christ-like spirit will Christianize everything it touches. A meek heart, in which the altar-fire of love to God is burning, will lay hold of the commonest, rudest things in life, and transmute them, like coarse fuel at the touch of fire, into a pure and holy flame. Religion in the soul will make all the work and toil of life, its gains and losses, friendships, rivalries, competitions, its manifold incidents and events, the means of religious advancement. Marble or coarse clay, it matters not much with which of these the artist works, the touch of genius transforms the coarser material into beauty, and lends to the finer a value it never had before. Lofty or lowly, rude or refined, as our earthly work may be, it will become to a holy mind only the material for something infinitely nobler than all the creations of genius—a pure and godlike life. To spiritualize what is material, to Christianize what is secular—this is the noble achievement of Christian principle. If you are a sincere Christian, it will be your great desire, by God's grace, to bring every gift, talent, occupation of life, every word you speak, every action you do, under the control of Christian motive. . . .

Rise superior, in Christ's strength, to all equivocal practices and advantages in trade; shrink from every approach to meanness or dishonesty; let your eye, fixed on a reward before which earthly wealth grows dim, beam with honour; let the thought of God make you self-restrained, temperate, watchful over speech and conduct; let the abiding sense of Christ's redeeming love to you make you gentle, self-denying, kind, and loving to all around you; then indeed will your secular life become spiritualized, whilst, at the same time, your spiritual life will grow more fervent; then not only will your prayers become more devout, but when the knee bends not, and the lip is silent, the life in its heavenward tone will "pray without ceasing." . . . The Christian life is not a thing of periodic observances, or of occasional fervours, or even of splendid acts of heroism and self-devotion, but of quiet, constant, unobtrusive earnestness, amidst the commonplace work of the world. This is the life to which Christ calls us. Is it yours? Have you entered upon it, or are you now willing to enter upon it? It is not, I admit, an imposing or an easy one. There is nothing in it to dazzle, much in its hardness and plainness to deter the irresolute. The life of a follower of Christ demands not, indeed, in our day, the courage of the hero or the martyr, the fortitude that braves outward dangers and sufferings, and flinches not from persecution and death. But with the age of persecution the difficulties of the Christian life have not passed away. In maintaining, in the unambitious routine of humble duties, a spirit of Christian cheerfulness and contentment—in preserving the fervour of piety amidst unexciting cares and wearing anxieties—in the perpetual reference to lofty ends amidst lowly toils—there may be evinced a faith as strong as that of the man who dies with the song of martyrdom on his lips. It is a great thing to love Christ so dearly as to be "ready to be bound and to *die*" for Him; but it is often a thing not less great to be ready to take up our daily cross, and to *live* for Him.

The Sparrow.—(From the German.)

Wherever there is a cottage, with a corn-field hard by, you will find a settlement of sparrows. Though it frequently happens that the same roof shelters both them and the swallows, the one bird differs entirely in character from the other. The sparrow has none of that neatness and elegance of appearance, none of that gentle timidity of disposition, which makes the swallow such a favourite guest with us. If any bird can be called vulgar, it is the sparrow. He is a low, cunning fellow, with a great many bad habits, and the consequence is, that he meets with nothing but persecution and contempt. His market price is assigned in the New Testament:—Five sparrows for a farthing. His dirty, rusty coat, stumpy shape, hurried, ungraceful flight, and tuneless voice, everything about him betrays his mean origin. But the shameless little cynic takes his revenge on society for treating him with coldness. Possession, custom, authority, nothing is sacred with him. As the fox drives the badger from his domicile by cunning, the sparrow harries the swallow of house and home by open violence. He likes the solid, tight, little, self-contained house, with the vaulted chamber. He breaks into it at some unguarded moment, and when its owners attempt to expel him, he repulses them obstinately and audaciously, vociferating as loudly as if he were the injured party. If, however, he cannot find a dwelling ready-made to his hand, and must set to work himself, he takes but little pains with his nest, and a most confused, unhandsome, tag-rag affair it turns out. Such as it is, it is chiefly the work of the female, for the sparrow, being no gentleman, makes his wife work harder than himself. A greedy fellow he is too, and fond of dainties, though he is not fond of work. He picks the first ripe cherry from the tree, and the last does not escape him. He stuffs himself with the ripening grain when it is full of milky juice. Yet our epicure can content himself with coarser fare, and in hard times little comes amiss to him. He will eat grubs, caterpillars, spiders, and all sorts of vermin; still corn is what he likes best. He follows the sower to the field, the thresher to the barn, the ostler to the binn, the horse to his crib, the hens to their scattered handful, the pigeons to the dovecot; nay, horrible to relate, he is even accused of picking holes in the crops of the young pigeons to get at the grain within.

During three quarters of the year the sparrow lives in affluence. On gardens, fields, and meadows, he makes his raids, and in harvest he is merciless to the reaped corn. He collects a multitude of his friends and kindred, and for whole days you may see the tribe whirring about from sheaf to sheaf. But when at length the fields are empty, and all the migratory birds are gone, then the sparrow retires to his winter quarters, to the streets of towns, to yards, and courts, and stables. The days of feasting are over, and the days of fasting have begun. The noisy braggart has become silent; cold and hunger press him hard. Then you may see him cowering among his fellows, his feathers puffed out round about him, his head drawn in between his shoulders, so that nothing of it is visible but beak and eye; or he shivers lonely in some sheltered corner, on a window-sill, or at the lee side of a chimney-stack. Yet let there but come some bright half-hour, that thaws a patch of snow from the roof, and the careless, joyous spirit of the vagabond wakes in him again; he hops, and flutters, and chirrups about, as brisk and gay as ever; for he knows that the winter-time does not last for ever, and that spring will not forget to spread his table anew.—After *Masius.*

Human Progress.—(Dugald Stewart.)

Views with respect to the probable improvement of the world are so conducive to the comfort of those who entertain them, that even, although they were founded in delusion, a wise man would be disposed to cherish them. What should have induced some respectable writers to controvert them with so great an asperity of expression, it is not easy to conjecture; for whatever may be thought of their truth, their practical tendency is surely favourable to human happiness; nor can that temper of mind, which disposes a man to give them a welcome reception, be candidly suspected of designs hostile to the interests of humanity.

One thing is certain, that the greatest of all obstacles to the improvement of the world, is that prevailing belief of its improbability, which damps the exertions of so many individuals; and that, in proportion as the contrary opinion becomes general, it realizes the events which it leads us to anticipate. Surely, if anything can have a tendency to call forth in the public service the exertions of individuals, it must be an idea of the magnitude of that work in which they are conspiring, and a belief of the permanence of those benefits which they confer on mankind by every attempt to inform and to enlighten them.

As in ancient Rome, therefore, it was regarded as the mark of a good citizen, never to despair of the fortunes of the republic; so the good citizen of the world, whatever may be the political aspect of his own times, will never despair of the fortunes of the human race, but will act upon the conviction that prejudice, slavery, and corruption, must gradually give way to truth, liberty, and virtue; and that, in the moral world, as well as in the material, the further our observations extend, and the longer they are continued, the more we shall perceive of order and of benevolent design in the universe.

The Vision of Mirza, exhibiting a Picture of Human Life.—(Addison.)

On the fifth day of the moon, which, according to the custom of my forefathers, I always keep holy, after having washed myself, and offered up my morning devotions, I ascended the high hills of Bagdat, in order to pass the rest of the day in meditation and prayer. As I was here airing myself on the tops of the mountains, I fell into a profound contemplation on the vanity of human life; and passing from one thought to another, Surely, said I, man is but a shadow, and life a dream. Whilst I was thus musing, I cast my eyes towards the summit of a rock that was not far from me, where I discovered one in the habit of a shepherd, with a little musical instrument in his hand. As I looked upon him, he applied it to his lips, and began to play upon it. The sound of it was exceeding sweet, and wrought into a variety of tunes that were inexpressibly melodious, and altogether different from anything I had ever heard: they put me in mind of those heavenly airs that are played to the departed souls of good men upon their first arrival in Paradise, to wear out the impressions of the last agonies, and qualify them for the pleasures of that happy place. My heart melted away in secret raptures.

I had been often told, that the rock before me was the haunt of a genius, and that several had been entertained with that music, who had passed by it, but never heard that the musician had before made himself visible. When he had raised my thoughts, by those transporting airs which he played, to taste the pleasures of his conversation, as I looked upon him like one astonished, he beckoned to me, and, by the waving of his hand, directed me to approach the place where he sat. I drew near with that reverence which is due to a superior nature, and as my heart was entirely subdued by the captivating strains I had heard, I fell down at his feet, and wept. The genius smiled upon me with a look of compassion and affability that familiarized him to my imagination, and at once dispelled all the fears and apprehensions with which I approached him. He lifted me from the ground, and taking me by the hand, "Mirza," said he, "I have heard thee in thy soliloquies ; follow me."

He then led me to the highest pinnacle of the rock, and placing me on the top of it, "Cast thine eyes eastward," said he, "and tell me what thou seest." "I see," said I, "a huge valley, and a prodigious tide of water rolling through it." "The valley that thou seest," said he, "is the vale of misery ; and the tide of water that thou seest, is part of the great tide of eternity." "What is the reason," said I, "that the tide I see rises out of a thick mist at one end, and again loses itself in a thick mist at the other?" "What thou seest," said he, "is that portion of eternity which is called Time, measured out by the sun, and reaching from the beginning of the world to its consummation. Examine now," said he, "this sea, that is bounded with darkness at both ends, and tell me what thou discoverest in it." "I see a bridge," said I, "standing in the midst of the tide." "The bridge thou seest," said he, "is human life ; consider it attentively." Upon a more leisurely survey of it, I found that it consisted of threescore and ten entire arches, with several broken arches, which, added to those that were entire, made up the number to about a hundred. As I was counting the arches, the genius told me that this bridge consisted at first of a thousand arches ; but that a great flood swept away the rest and left the bridge in the ruinous condition in which I now beheld it : "but tell me further," said he, "what thou discoverest on it." "I see multitudes of people passing over it," said I, "and a black cloud hanging on each end of it." As I looked more attentively, I saw several of the passengers dropping through the bridge into the great tide that flowed underneath it; and, upon further examination, perceived there were innumerable trap-doors that lay concealed in the bridge, which the passengers no sooner trod upon, but they fell through them into the tide, and immediately disappeared. These hidden pit-falls were set very thick at the entrance of the bridge, so that throngs of people no sooner broke through the cloud, but many of them fell into them. They grew thinner towards the middle, but multiplied and lay closer together towards the end of the arches that were entire. There were indeed some persons, but their number was very small, that continued a kind of hobbling march on the broken arches, but fell through one after another, being quite tired and spent with so long a walk.

I passed some time in the contemplation of this wonderful structure, and the great variety of objects which it presented. My heart was filled with a deep melancholy, to see several dropping unexpectedly in the midst of mirth and jollity, and catching at everything that stood by them, to save themselves. Some were looking up towards the heavens in a thoughtful posture, and, in the midst of a speculation, stumbled and fell out of sight. Multitudes were very busy in the pursuit of bubbles, that glittered in their eyes, and danced before them; but often, when they thought themselves within reach of them, their footing failed and down they sunk. In this confusion of objects, I observed some with scimitars in their hands, and others with urinals, who ran to and fro upon the bridge, thrusting several persons on trap-doors which did not seem to lie in their way, and which they might have escaped had they not been thus forced upon them.

The genius, seeing me indulge myself in this melancholy prospect, told me I had dwelt long enough upon it: "Take thine eyes off the bridge," said he, "and tell me if thou seest anything thou dost not comprehend." Upon looking up, "What mean," said I, "those great flights of birds that are perpetually hovering about the bridge, and settling upon it from time to time? I see vultures, harpies, ravens, cormorants, and, among many other feathered creatures, several little winged boys, that perch in great numbers upon the middle arches." "These." said the genius, "are envy, avarice, superstition, despair, love, with the like cares and passions that infest human life." . . . . .

The genius then directed my attention to a vast ocean planted with innumerable islands, that were covered with fruits and flowers, and interwoven with a thousand little shining seas that ran among them. . . "These," said he, "are the mansions of good men after death, who, according to the degree and kinds of virtue in which they excelled, are distributed among these several islands, which abound with pleasures of different kinds and degrees, suitable to the relishes and perfections of those who are settled in them: every island is a paradise accommodated to its respective inhabitants. Are not these, O Mirza, habitations worth contending for? Does life appear miserable, that gives thee opportunities of earning such a reward? Is death to be feared, that will convey thee to so happy an existence? Think not man was made in vain, who has such an eternity reserved for him." I gazed with inexpressible pleasure on these happy islands. At length, said I, "Show me now, I beseech thee, the secrets that lie hid under those dark clouds, which cover the ocean on the other side of the rock of adamant." The genius making me no answer, I turned about to address myself to him a second time, but I found that he had left me. I then turned again to the vision which I had been so long contemplating; but instead of the rolling tide, the arched bridge, and the happy islands, I saw nothing but the long hollow valley of Bagdat, with oxen, sheep, and camels, grazing upon the sides of it.

Departure and Death of Nelson.—(Southey.)

Nelson having despatched his business at Portsmouth, endeavoured to elude the populace by taking a by-way to the beach, but a crowd collected in his train, pressing forward to obtain a sight of his face: many were in tears, and many knelt down before him, and blessed him as he passed. England has had many heroes, but never one who so entirely possessed the love of his fellow-countrymen as Nelson. All men knew that his heart was as humane as it was fearless; that there was not in his nature the slightest alloy of selfishness or cupidity; but that, with perfect and entire devotion, he served his country with all his heart, and with all his soul, and with all his strength; and therefore they loved him as truly and as fervently as he loved England. They pressed upon the parapet to gaze after him when his barge pushed off, and he returned their cheers by waving his hat. The sentinels who endeavoured to prevent them from trespassing upon this ground, were wedged among the crowd ; and an officer who, not very prudently upon such an occasion, ordered them to drive the people down with their bayonets, was compelled speedily to retreat; for the people would not be debarred from gazing till the last moment upon the hero—the darling hero of England! . . . It had been part of Nelson's prayer, that the British fleet might be distinguished by humanity in the victory which he expected. Setting an example himself, he twice gave orders to cease firing on the Redoubtable, supposing that she had struck, because her guns were silent; for, as she carried no flag, there was no means of instantly ascertaining the fact. From this ship, which he had thus twice spared, he received his death. A ball fired from her mizen-top, which, in the then situation of the two vessels, was not more than fifteen yards from that part of the deck where he was standing, struck the epaulette on his left shoulder, about a quarter after one, just in the heat of action. He fell upon his face, on the spot which was covered with his poor secretary's blood. Hardy, who was a few steps from him, turning round, saw three men raising him up. "They have done for me at last, Hardy," said he. "I hope not," cried Hardy. "Yes," he replied, "my back-bone is shot through." Yet even now, not for a moment losing his presence of mind, he observed, as they were carrying him down the ladder, that the tiller ropes, which had been shot away, were not yet replaced, and ordered that new ones should be rove immediately: then, that he might not be seen by the crew, he took out his handkerchief, and covered his face and his stars. Had he but concealed these badges of honour from the enemy, England, perhaps, would not have had cause to receive with sorrow the news of the battle of Trafalgar. The cockpit was crowded with wounded and dying men, over whose bodies he was with some difficulty conveyed, and laid upon a pallet in the midshipmen's berth. It was soon perceived, upon examination, that the wound was mortal. This, however, was concealed from all except Captain Hardy, the chaplain, and the medical attendants. He himself being certain, from the sensation in his back, and the gush of blood he felt momently within his breast, that no human care could avail him, insisted that the surgeon should leave him, and attend to those to whom he might be useful; "for," said he, "you can do nothing for me." All that could be done was to fan him with paper, and frequently to give him lemonade to alleviate his intense thirst. He was in great pain, and expressed much anxiety for the event of the action, which now began to declare itself. As often as a ship struck, the crew of the Victory hurrahed, and at every hurrah, a visible expression of joy gleamed in the eyes, and marked the countenance of the dying hero. But he became impatient to see Hardy; and as that officer, though often sent for, could not leave the deck, Nelson feared that some fatal cause prevented him, and repeatedly cried, "Will no one bring Hardy to me? he must be killed! he is surely dead!" An hour and ten minutes elapsed from the time when Nelson received his wound, before Hardy could come to him. They shook hands in silence, Hardy in vain struggling to suppress the feelings of that most painful and yet sublime moment. "Well, Hardy," said Nelson, "how goes the day with us?" "Very well," replied Hardy; "ten ships have struck, but five of the van have tacked, and show an intention to bear down upon the Victory. I have called two or three of our fresh ships round, and have no doubt of giving them a drubbing." "I hope," said Nelson, "none of our ships have struck." Hardy answered, "there was no fear of that." Then, and not till then, Nelson spoke of himself. "I am a dead man, Hardy," said he; "I am going fast; it will be all over with me soon. Come nearer to me. Let my dear Lady Hamilton have my hair, and all other things belonging to me." Hardy observed, that he hoped Mr. Beatty could yet hold out some prospect of life. "Oh! no," he replied; "it is impossible. My back is shot through. Beatty will tell you so." Hardy then once more shook hands with him, and with a heart almost bursting, hastened upon deck.

By this time all feeling below the breast was gone, and Nelson, having made the surgeon ascertain this, said to him: "You know I am gone. I know it. I feel something rising in my breast," putting his hand on his left side, "which tells me so." And upon Beatty's inquiring whether his pain was very great, he replied, "so great that he wished he was dead. Yet," said he, in a lower voice, "one would like to live a little longer too!" And after a few minutes, in the same undertone, he added: "What would become of poor Lady Hamilton if she knew my situation?" Next to his country she occupied his thoughts. Captain Hardy, some fifty minutes after he had left the cockpit, returned, and again taking the hand of his dying friend and commander, congratulated him on having gained a complete victory. How many of the enemy were taken he did not know, as it was impossible to perceive them distinctly, but fourteen or fifteen at least. "That's well," cried Nelson, "but I bargained for twenty." And then, in a stronger voice, he said: "Anchor, Hardy, anchor." Hardy, upon this, hinted that Admiral Collingwood would take upon himself the direction of affairs. "Not while I live, Hardy," said the dying Nelson, ineffectually endeavouring to raise himself from the bed: "do you anchor." His previous orders for preparing to anchor had shown how clearly he foresaw the necessity of this. Presently calling Hardy back, he said to him in a low voice, "Don't throw me overboard;" and he desired that he might be buried by his parents, unless it should please the king to order otherwise. Then reverting to private feelings: "Take care of my dear Lady Hamilton, Hardy; take care of poor Lady Hamilton. Kiss me, Hardy," said he. Hardy knelt down and kissed his cheek; and Nelson said, "Now I am satisfied. Thank God I have done my duty!" Hardy stood over him in silence for a moment or two, then knelt again and kissed his forehead. "Who is that?" said Nelson; and being informed, he replied, "God bless you, Hardy." And Hardy then left him for ever. Nelson now desired to be turned upon his right side, and said, "I wish I had not left the deck; for I shall soon be gone." Death was, indeed, rapidly approaching. He said to the chaplain, "Doctor, I have *not* been a *great* sinner;" and after a short pause, "Remember that I leave Lady Hamilton and my daughter Horatia as a legacy to my country." His articulation now became difficult; but he was distinctly heard to say, "Thank God, I have done my duty!" These words he repeatedly pronounced, and they were the last words which he uttered. He expired at thirty minutes after four, three hours and a quarter after he had received his wound.

The death of Nelson was felt in England as something more than a public calamity; men started at the intelligence, and turned pale, as if they had heard of the loss of a dear friend. An object of our admiration and affection, of our pride and of our hopes, was suddenly taken from us; and it seemed as if we had never till then known how deeply we loved and reverenced him. What the country had lost in its great naval hero—the greatest of our own and of all former times—was scarcely taken into the account of grief. So perfectly, indeed, had he performed his part, that the maritime war, after the battle of Trafalgar, was considered at an end. The fleets of the enemy were not merely defeated but destroyed; new navies must be built, and a new race of seamen reared for them, before the possibility of their invading our shores could again be contemplated. It was not, therefore, from any selfish reflection upon the magnitude of our loss that we mourned for him: the general sorrow was of a higher character. The people of England grieved that funeral ceremonies, and public monuments, and posthumous rewards, were all which they could now bestow upon him whom the king, the legislature, and the nation would have alike delighted to honour; whom every tongue would have blessed; whose presence in every village through which he might have passed would have wakened the church-bells, have given schoolboys a holiday, have drawn children from their sports to gaze upon him, and "old men from the chimney-corner" to look upon Nelson ere they died. The victory of Trafalgar was celebrated indeed with the usual forms of rejoicing, but they were without joy; for such already was the glory of the British navy, through Nelson's surpassing genius, that it scarcely seemed to receive any addition from the most signal victory that ever was achieved upon the seas; and the destruction of this mighty fleet, by which all the maritime schemes of France were totally frustrated, hardly appeared to add to our security or strength; for while Nelson was living to watch the combined squadrons of the enemy, we felt ourselves as secure as now, when they were no longer in existence.

There was reason to suppose, from the appearances upon opening his body, that in the course of nature he might have attained, like his father, to a good old age. Yet he cannot be said to have fallen prematurely whose work was done; nor ought he to be lamented, who died so full of honours, and at the height of human fame. The most triumphant death is that of the martyr; the most awful, that of the martyred patriot; the most splendid, that of the hero in the hour of victory; and if the chariot and the horses of fire had been vouchsafed for Nelson's translation, he could scarcely have departed in a brighter blaze of glory. He has left us, not indeed his mantle of inspiration, but a name and an example which are at this hour inspiring thousands of the youth of England—a name which is our pride, and an example which will continue to be our shield and our strength. Thus it is that the spirits of the great and the wise continue to live and to act after them.

Reading.—(John Locke.)

There is not seldom to be found, even amongst those who aim at knowledge, men, who with an unwearied industry employ their whole time in books, who scarce allow themselves time to eat or sleep, but read, and read, and read on, and yet make no great advances in real knowledge, though there be no defect in their intellectual faculties to which their little progress can be imputed. The mistake here is, that it is usually supposed that by reading, the author's knowledge is transferred into the reader's understanding; and so it is, but not by bare reading, but by reading and understanding what he writ. Whereby I mean, not barely comprehending what is affirmed or denied in each proposition (though that great readers do not think themselves concerned precisely to do), but to see and follow the train of his reasonings, observe the strength and clearness of their connexion, and examine upon what they bottom. Without this a man may read the discourses of a very rational author, writ in a language and in propositions that he very well understands, and yet acquire not one jot of his knowledge; which consisting only in the perceived, certain, or probable connexion of the ideas made use of in his reasonings, the reader's knowledge is no further increased, than he perceives that, so much as he sees of this connexion, so much he knows of the truth or probability of that author's opinions.

Marie Antoinette, Queen of France.—(Burke.)

It is now sixteen or seventeen years since I saw the Queen of France, then the dauphiness, at Versailles; and surely never lighted on this orb, which she hardly seemed to touch, a more delightful vision. I saw her just above the horizon, decorating and cheering the elevated sphere she just began to move in—glittering like the morning star full of life, and splendour, and joy. Oh! what a revolution! and what a heart must I have to contemplate without emotion that elevation and that fall! Little did I dream, when she added titles of veneration to that enthusiastic, distant, respectful love, that she should ever be obliged to carry the sharp antidote against disgrace concealed in that bosom; little did I dream that I should have lived to see such disasters fallen upon her in a nation of gallant men, in a nation of men of honour and of cavaliers I thought ten thousand swords must have leapt from their scabbards to avenge even a look that threatened her with insult. But the age of chivalry is gone. That of sophisters, economists, and calculators has succeeded; and the glory of Europe is extinguished for ever. Never, never more shall we behold that generous loyalty to rank and sex, that proud submission, that dignified obedience, that subordination of the heart, which kept alive, even in servitude itself, the spirit of an exalted freedom. The unbought grace of life, the cheap defence of nations, the nurse of manly sentiment and heroic enterprise is gone! It is gone, that sensibility of principle, that chastity of honour, which felt a stain like a wound, which inspired courage whilst it mitigated ferocity, which ennobled whatever it touched, and under which vice itself lost half its evil by losing all its grossness.—*From Reflections on the Revolution in France.*

THE DEAD ASS.—(STERNE.)

"AND this," said he (putting the remains of a crust into his wallet),—"and this should have been *thy* portion," said he, "hadst thou been alive to have shared it with me." I thought, by the accent, it had been an apostrophe to his child, but it was to his ass; and to the very ass we had seen dead on the road, which had occasioned La Fleur's misadventure. The man seemed to lament it much; and it instantly brought into my mind Sancho's lamentation for his; but he did it with more *true* touches of nature.

The mourner was sitting upon a stone bench at the door, with the ass's pannel and its bridle on one side, which he took up from time to time—then laid them down—looked at them, and shook his head. He then took his crust of bread out of his wallet again, as if to eat it, held it some time in his hand—then laid it upon the bit of his ass's bridle—looked wistfully at the little arrangements he had made, and then gave a sigh.

The *simplicity* of his grief drew numbers about him, and La Fleur among the rest, while the horses were getting ready: as I continued sitting in the post-chaise, I could see and hear over their heads.

He said he had come last from Spain, where he had been from the farthest borders of Franconia; and had got so far on his return home, when the ass died. Every one seemed desirous to know *what* business could have taken so *old* and *poor* a man so far a journey from his own home.

It had pleased Heaven, he said, to bless him with three sons, the finest lads in all Germany; but, having in one week lost two of them by the smallpox, and the youngest falling ill of the same distemper, he was afraid of being bereft of them all, and made a vow, if Heaven would not take *him* from him also, he would go in gratitude to St. Iago in Spain.

When the mourner got thus far in his story, he stopped, to pay nature her tribute, and wept bitterly.

He said Heaven had accepted the conditions, and that he ha set out from his cottage with this poor creature, who had been a *patient partner* of his journey; that it had eaten the same bread with him all the way, and was unto him as a *friend.*

Everybody who stood about heard the poor fellow with con cern; La Fleur offered him money: The mourner said he did not want it—it was not the *value* of the ass, but the *loss* of him. The ass, he said he was assured, loved him; and, upon this, told them a long story of a mischance upon their passage over the Pyrenean mountains, which had separated them from each other three days, during which time the ass had sought *him* as much as he had sought the *ass,* and that neither had scarce eaten nor drunk till they met.

"Thou hast *one* comfort, friend," said I, "at least, in the loss of thy poor beast; I am sure thou hast been a merciful master to him." "Alas!" said the mourner, "I thought so when he was alive, but now he is dead I think otherwise. I fear the weight of *myself* and my *afflictions* together, have been too much for him; they have shortened the poor creature's days, and I fear I have them to answer for." Shame on the world! (said I to myself.) Did we but love *each other* as this poor soul loved his *ass,* 'twould be something.

THE LOVE OF NATURE.—(DR. BEATTIE—*Abridged.*)

IT is strange to observe the callousness of some men, before whom all the glories of heaven and earth pass in daily succession, without touching their hearts, elevating their fancy, or leaving any durable remembrance. Even of those who pretend to sensibility, how many are there to whom the lustre of the rising or setting sun, the sparkling concave of the midnight sky, the mountain forest tossing and roaring to the storm, or warbling with al the melodies of a summer evening; the sweet interchange of hill and dale, shade and sunshine, grove, lawn, and water, which an extensive landscape offers to the view; the scenery of the ocean, so lovely, so majestic, and so tremendous, and the many pleasing varieties of the animal and vegetable kingdom, could never afford so much real satisfaction as the steams and noise of a ball-room, the insipid fiddling and squeaking of an opera, or the vexations and wranglings of a card-table!

But some minds there are of a different make, who, even in the early part of life, receive from the contemplation of nature a species of delight which they would hardly exchange for any other; and who, as avarice and ambition are not the infirmities of that period, would, with equal sincerity and rapture, exclaim,—

"I care not, Fortune, what you me deny;
You cannot rob me of free nature's grace,
You cannot shut the windows of the sky,
Through which Aurora shows her brightening face;
You cannot bar my constant feet to trace
The woods and lawns by living stream at eve."

To a mind thus disposed, no part of creation is indifferent. In the crowded city and howling wilderness, in the cultivated province and solitary isle, in the flowery lawn and craggy mountain, in the murmur of the rivulet and in the uproar of the ocean, in the radiance of summer and gloom of winter, in the thunder of heaven and in the whisper of the breeze, he still finds something to rouse or to soothe his imagination, to draw forth his affections, or to employ his understanding.

This happy sensibility to the beauties of nature should be cherished in young persons. It engages them to contemplate the Creator in his wonderful works; it purifies and harmonizes the soul, and prepares it for moral and intellectual discipline; it supplies a never-failing source of amusement; it contributes even to bodily health; and, as a strict analogy subsists between material and moral beauty, it leads the heart by an easy transition from the one to the other, and thus recommends virtue for its transcendent loveliness, and makes vice appear the object of contempt and abomination.

> "O how canst thou renounce the boundless store
> Of charms which Nature to her votaries yields?
> The warbling woodland, the resounding shore,
> The pomp of groves and garniture of fields;
> All that the genial ray of morning gilds,
> And all that echoes to the song of even:
> All that the mountain's sheltering bosom shields,
> And all the dread magnificence of heaven;
> O how canst thou renounce, and hope to be forgiven?"

On Improvement.—(Kingsley's *Village Sermons.*)

The Bible is always telling Christian people to go forwards—to grow—to become wiser and stronger, better and better day by day; that they ought to become better and better, because they can, if they choose, improve. This text tells us so; it says that we shall bring forth more fruit in our old age. Another text tells us, that "those who wait on the Lord shall renew their strength;" another tells us, that we "shall go from strength to strength." Not one of St. Paul's Epistles but talks of growing in grace, and in the knowledge of God, of being filled with God's spirit, of having our eyes more and more open to understand God's truth. Not one of St. Paul's Epistles but contains prayers of St. Paul, that the men to whom he writes may become holier and wiser. And St. Paul says that he himself needed to go forward; that he wanted fresh strength; that he had to forget what was past, and consider all he had done and felt as nothing, and press forward to the prize of his high calling; that he needed to be daily conquering himself more and more, keeping down his bad feelings, hunting out one bad habit after another, lest by any means, when he had preached to others, he himself should become a castaway. Therefore, I said rightly, that the Bible is always bidding us go forwards. You cannot read your Bible without seeing this. What else was the use of St. Paul's Epistles? They were written to Christian men, redeemed men, converted men, most of them better, I fear, than ever we shall be; and for what? to tell them not to be content to remain as they were, but to go forwards, to improve, to remember that they were only just inside the gate of God's kingdom, and that, if they would go on to perfection, they would find strength, and holiness, and blessing, and honour, and happiness, which they as yet did not dream of. "Be ye perfect, even as your Father which is in heaven is perfect," said our blessed Lord to all men. "Be ye perfect," says St. Paul to the Corinthians, and to the Ephesians, and all to whom he wrote; and so say I to you now in God's name, for Christ's sake, as citizens of God's kingdom, as heirs of everlasting glory, "Be you perfect, even as your Father in heaven is perfect." Now, I ask you, my friends, is not this reasonable? It is reasonable, for the Bible always speaks of our souls as living things. It compares them to limbs of a body, to branches of a tree, often to separate plants, as in our Lord's parable of the tares and the wheat. Again, St. Paul tells us that we have been planted in baptism, in the likeness of Christ's death; and again, in the first Psalm, which says that the good man shall be like a tree planted by the waterside; and again in the text of my sermon, which says, "that those who are planted in the house of the Lord shall flourish in the courts of our God. They shall still bring forth fruit in old age; they shall be fat and flourishing."

Now, what does all this mean? It means that the life of our souls is in some respects like the life of a plant; and therefore, that as plants grow, so our souls are to grow. Why do you plant anything but in order that it may grow and become larger, stronger, bear flower and fruit? Be sure God has planted us in His garden, Christ's church, for no other reason. Consider again, what is life but a continual growing, or a continual decaying? If a tree does not get larger and stronger year by year, is not that a sure sign that it is unhealthy, and that decay has begun in it; that it is unsound at heart? and what happens then? It becomes weaker and smaller, and cankered, and choked with scurf and moss, till it dies. If a tree is not growing, it is sure in the long run to be dying; and so are our souls. If they are not growing, they are dying; if they are not getting better, they are getting worse. This is why the Bible compares our souls to trees—not out of a mere pretty fancy of poetry, but for a great, awful, deep, world-wide lesson, that every tree in the fields may be a pattern, a warning, to us thoughtless men, that as that tree is meant to grow, so our souls are meant to grow; as that tree dies, unless it grows, so our souls must die, unless they grow. Consider that!

But how does a tree grow? How are our souls to grow? Now, here again we shall understand heavenly things best, by taking and considering the pattern from among earthly things which the Bible gives us—the tree I mean. A tree grows in two ways. Its roots take up food from the ground, its leaves take up food from the air. Its roots are its mouth, we may say, and its leaves are its lungs. Thus the tree draws nourishment from the earth beneath and the heaven above, and so must our souls, my friends; if they are to live and grow, they must have food both from earth and from heaven. And this is what I mean.

Why has God given us senses, eyes, and ears, and understanding? That by them we may feed our souls with things which we see and hear, things which are going on in the world round us. We must read and we must listen, and we must watch people and their sayings and doings, and what becomes of them; and we must try and act, and practise what is right for ourselves, and so we shall, by using our eyes and ears, and our bodies, get practice, and experience, and knowledge from the world round us—such as Solomon gives us in his Proverbs; and so our eyes, and ears, and understanding, are to be to us like roots, by which we may feed our souls with earthly learning and experience. But is this enough? No, surely. Consider again God's example which he has given us—a tree. If you keep stripping all the leaves off a tree as fast as they grow, what becomes of it? It dies, because without leaves it cannot get nourishment from the air, and the rain, and the sunlight. Again, if you shut up a tree where it can get neither rain, air, nor light, what happens? The tree certainly dies, though it may be planted in the very richest soil, and have the very strongest roots, and why? because it can get no food from the sky above; so with our souls, my friends. If we get no food from above, our souls will die, though we have all the wit, and learning, and experience in the world. We must be fed and strengthened, and satisfied, with the grace of God from above—with the spirit of God. Consider how the Bible speaks of God's spirit, as the breath of God; for the very word *spirit* means, originally, breath or air, or gas, or a breeze of wind, showing us that as without the airs of heaven the tree would become stunted and cankered, so our souls will, without the fresh purifying breath of God's spirit. Again, God's spirit is often spoken of in Scripture as dew and rain. His grace or favour, we read, is as dew on the grass; and again, that God shall come unto us as the rain, as the former and latter rain upon the earth; and again, speaking of the outpouring of God's Spirit on His Church, the Psalmist says that "He shall come down like rain upon the mown grass; as showers that water the earth;" and to show us that as the tree puts forth buds and leaves, and tender wood, when it drinks in the dew and rains, so our hearts will become tender, and bud out into good thoughts and wise resolves, when God's Spirit fills them with His grace.

Moreover, the Scripture tells us again and again that our souls want light from above; and we all know by experience that the trees and plants which grow on earth want the light of the sun to make them grow. So, doubtless, in this case also, the scriptural example of a tree will hold good. Now, what does the sunlight do for a tree? It does everything, for without light the soil, and air, and rain, are all useless. It stirs up the sap, it hardens the wood, it brings out the blossom, it colours the leaves and the flowers, it ripens the fruit. The light is the life of the tree; and is there not one, my friends, of whom these words are written—that He is the life, and that He is the light—that He is the Sun of Righteousness, and the bright and Morning Star—that He is the light which lighteth every one that cometh into the world, and that in Him was life, and the life was the light of men? Do you not know of whom I speak? Even of Him that was born at Bethlehem, and died on the cross, who is now at God's right hand praying for us, offering to us His body and His blood; Jesus the Son of God, He is the light and the life. From Him alone our light must come, from Him alone our life must come, now and for ever.

A Gigantic Iceberg.—(Dana's *Two Years before the Mast.*)

At twelve o'clock we went below, and had just got through dinner, when the cook put his head down the scuttle and told us to come on deck and see the finest sight that we had ever seen. "Where away, cook?" asked the first man who was up. "On the larboard bow." And there lay floating in the ocean, several miles off, an immense irregular mass, its top and points covered with snow, and its centre of a deep indigo colour. This was an iceberg, and of the largest size, as one of our men said, who had been in the Northern Ocean. As far as the eye could reach, the sea in every direction was of a deep blue colour, the waves running high and fresh, and sparkling in the light, and in the midst lay this immense mountain-island, its cavities and valleys thrown into deep shade, and its points and pinnacles glittering in the sun. All hands were soon on deck looking at it, and admiring in various ways its beauty and grandeur. But no description can give any idea of the strangeness, splendour, and really the sublimity of the sight. Its great size, for it must have been two or three miles in circumference, and several hundred feet in height, its slow motion as its base rose and sank in the water, and its high points nodded against the clouds. The dashing of the waves upon it, which, breaking high with foam, lined its base with a white crust, and the thundering sound of the cracking of the mass, and the breaking and tumbling down of huge pieces, together with its nearness and approach, which added a slight element of fear, all combined to give it the character of true sublimity. The main body of the mass was, as I have said, of an indigo colour, its base crusted with frozen foam; and as it grew thin and transparent towards the edges and top, its colour shaded off from a deep blue to the whiteness of snow. It seemed to be drifting slowly towards the north, so that we kept away and avoided it. It was in sight all the afternoon, and when we got to leeward of it, the wind died away, so that we lay-to quite near it for a greater part of the night. Unfortunately there was no moon; but it was a clear night, and we could plainly mark the long, regular heaving of the stupendous mass as its edges moved slowly against the stars. Several times in our watch loud cracks were heard, which sounded as though they must have run through the whole length of the iceberg, and several pieces fell down with a thundering crash, plunging heavily into the sea. Towards morning, a strong breeze sprang up, and we filled away and left it astern, and at daylight it was out of sight. . . . . . No pencil has ever yet given anything like the true effect of an iceberg. In a picture they are huge uncouth masses stuck in the sea; while their chief beauty and grandeur, their slow, stately motion, the whirling of the snow about their summits, and the fearful groaning and crackling of their parts, the picture cannot give. This is the large iceberg; while the small and distant islands, floating on the smooth sea, in the light of a clear day, look like little floating fairy isles of sapphire.

Labour and Rest.—(Samuel Johnson.)

To oppose the devastations of Famine, who scattered the ground everywhere with carcases, Labour came down upon earth. Labour was the son of Necessity, the nursling of Hope, and the pupil of Art; he had the strength of his mother, the spirit of his nurse, and the dexterity of his governess. His face was wrinkled with the wind and swarthy with the sun; he had the implements of husbandry in one hand, with which he turned up the earth, in the other he had the tools of architecture, and raised walls and towers at his pleasure.

He called out with a rough voice—"Mortals! see here the power to whom you are consigned, and from whom you are to hope for all your pleasures and for all your safety. You have long languished under the dominion of Rest, an impotent and deceitful goddess, who can neither protect nor relieve you, but resigns you to the first attacks of either Famine or Disease, and suffers her shades to be invaded by every enemy and destroyed by every accident. Awake therefore to the call of Labour. I will teach you to remedy the sterility of the earth and the severity of the sky; I will compel summer to find provisions for the winter; I will force the waters to give you their fish, the air its fowls, and the forests their beasts; I will teach you to pierce the bowels of the earth, and bring out from the caverns of the mountains, metals which shall give strength to your hands and security to your bodies, by which you may be covered from the assaults of the fiercest beasts, and with which you shall fell the oak, and divide rocks, and subject all nature to your use and pleasure."

Encouraged by this magnificent invitation, the inhabitants of the globe considered Labour as their only friend, and hasted to his command. He led them out to the fields and mountains, and showed them how to open mines, to level hills, to drain marshes, and change the course of rivers. The face of things was immediately transformed; the land was covered with towns and villages, encompassed with fields of corn, and plantations of fruit-trees; and nothing was seen but heaps of grain, and baskets of fruit, full tables, and crowded storehouses.

Thus Labour and his followers added every hour new acquisitions to their conquests, and saw Famine gradually dispossessed of his dominions; till at last, amid their jollity and triumphs, they were depressed and amazed by the approach of Lassitude, who was known by her sunken eyes and dejected countenance. She came forward trembling and groaning; at every groan the hearts of all those that beheld her lost their courage, their nerves slackened, their hands shook, and the instruments of labour fell from their grasp. Shocked with this horrid phantom, they reflected with regret on their easy compliance with the solicitations of Labour, and began to wish again for the golden hours which they remembered to have passed under the reign of Rest, whom they resolved to re-visit, and to whom they intended to dedicate the remaining part of their lives. Rest had not left the world; they quickly found her, and, to atone for their former desertion, invited her to the enjoyment of those acquisitions which Labour had procured them.

Rest, therefore, took leave of the groves and valleys which she had hitherto inhabited, and entered into palaces, reposed herself in alcoves, and slumbered away the winter upon beds of down, and the summer in artificial grottoes with cascades playing before her. There was indeed always something wanting to complete her felicity, and she could never lull her returning fugitives to that serenity which they knew before their engagements with Labour; nor was her dominion entirely without control, for she was obliged to share it with Luxury, though she always looked upon her as a false friend, by whom her influence was in reality destroyed while it seemed to be promoted. The two soft associates, however, reigned for some time without visible disagreement, till at last, Luxury betrayed her charge, and let in Disease to seize upon her worshippers. Rest then flew away and left the place to the usurpers, who employed all their arts to fortify themselves in their possession, and to strengthen the interest of each other.

Rest had not always the same enemy; in some places she escaped the incursions of Disease, but had her residence invaded by a more slow and subtle intruder, for very frequently, when everything was composed and quiet, when there was neither pain within nor danger without, when every flower was in bloom and every gale freighted with perfumes, Satiety would enter with a languishing and repining look, and throw herself upon the couch placed and adorned for the accommodation of Rest.

No sooner was she seated than a general gloom spread itself on every side; the groves immediately lost their verdure, and their inhabitants desisted from their melody, the breeze sunk in sighs, and the flowers contracted their leaves and shut up their odours. Nothing was seen on every side but multitudes wandering about they knew not whither, in quest they knew not of what; no voice was heard but of complaints that mentioned no pain, and murmurs that could tell of no misfortune. Rest had now lost her authority. Her followers again began to treat her with contempt; some of them united themselves more closely to Luxury, who promised by her arts to drive Satiety away; and others, that were more wise

THE EARTHQUAKE AT LISBON.—(DAVY.)

THERE never was a finer morning seen than the first of November; the sun shone out in its full lustre; the whole face of the sky was perfectly serene and clear; and not the least signal or warning of that approaching event, which has made this once flourishing, opulent, and populous city, a scene of the utmost horror and desolation, except only such as served to alarm, but scarcely left a moment's time to fly from the general destruction.

It was on the morning of this fatal day between the hours of

therefore at last determined upon an interview, in which they agreed to divide the world between them, and govern it alternately, allotting the dominion of the day to one, and that of the night to the other, and promised to guard the frontiers of each other, so that whenever hostilities were attempted, Satiety should be intercepted by Labour and Lassitude expelled by Rest.

WHAT WORK HAS DONE.—(THOMAS CARLYLE.)

IT is all work, and forgotten work, this peopled, clothed, articulate-speaking, high-towered, wide-acred world. The hands of forgotten brave men have made it a world for us; they—honour to them, in *spite* of the idle and the dastard. This English land, here and now, is the summary of what was found of wise, and noble, and accordant with God's truth, in all the generations of Englishmen. Our English speech is speakable because there were hero-poets of our blood and lineage; speakable in proportion to the number of these. This land of England has its conquerors, possessors which change from epoch to epoch, from day to day; but its real conquerors, creators, and eternal proprietors, are these following, and their representatives if you can find them. All the heroic souls that ever were in England, each in their degree, all the men that have ever cut a thistle, drained a puddle out of England, contrived a wise scheme in England, done or said a true or valiant thing in England, I tell thee they had not a hammer to begin with, and yet Wren built St. Paul's.—*Past and Present.*

THE MOST HONOURABLE.—(THOMAS CARLYLE.)

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thy back so bent, for us were thy straight limbs and fingers so deformed; thou wert our conscript on whom the lot fell, and fighting our battles, wert so marred. For in thee too lay a God-created form, but it was not to be unfolded; encrusted must it stand with the thick adhesions and defacements of labour, and thy body, like thy soul, was not to know freedom. Yet toil on, toil on, *thou* art in thy duty be out of it who may; thou toilest for the altogether indispensable, for daily bread. A second man I honour and still more highly, him who is seen toiling for the spiritually indispensable, not daily bread but the bread of life. Is not he too in his duty, endeavouring towards inward harmony, revealing this by act or by word through all his outward endeavours, be they high or low? Highest of all when his outward and his inward endeavour are one; when we can name him artist, not earthly craftsman only, but inspired thinker, who with heaven-made implements conquers heaven for us! If the poor and humble toil that we have food, must not the high and glorious toil for him in return, that he have light, have guidance, freedom, immortality? These two in all their degrees I honour; all else is chaff and dust, which let the wind blow whither it listeth. Unspeakably touching is it, however, when I find both dignities united, and he that must toil outwardly for the lowest of man's wants, is also toiling inwardly for the highest. Sublimer in this world know I nothing than a peasant-saint. Could such now anywhere be met with, such a one will take thee back to Nazareth itself; thou wilt see the splendour of heaven spring forth from the humblest depths of earth like a light shining in great darkness.—*Sartor Resartus.*

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It was on the morning of this fatal day, between the hours of nine and ten, that I was set down in my apartment, just finishing a letter, when the papers and table I was writing on, began to tremble with a gentle motion, which rather surprised me, as I could not perceive a breath of wind stirring. Whilst I was reflecting with myself what this could be owing to, but without having the least apprehension of the real cause, the whole house began to shake from the very foundation, which at first I imputed to the rattling of several coaches in the main street, which usually passed that way, at this time, from Belem to the palace; but on hearkening more attentively, I was soon undeceived, as I found it was owing to a strange frightful kind of noise under ground, resembling the hollow distant rumbling of thunder. All this passed in less than a minute, and I must confess I now began to be alarmed, as it naturally occurred to me that this noise might possibly be the forerunner of an earthquake, as one I remembered, which had happened about six or seven years ago, in the island of Madeira, commenced in the same manner, though it did little or no damage.

Upon this I threw down my pen, and started upon my feet, remaining a moment in suspense, whether I should stay in the apartment or run into the street, as the danger in both places seemed equal; and still flattering myself that this tremor might produce no other effects than such inconsiderable ones as had been felt at Madeira; but in a moment I was roused from my dream, being instantly stunned with a most horrid crash, as if every edifice in the city had tumbled down at once. The house in which I was shook with such violence, that the upper storeys immediately fell, and though my apartment (which was the first floor) did not then share the same fate, yet everything was thrown out of its place, in such a manner that it was with no small difficulty I kept my feet, and expected nothing less than to be soon crushed to death, as the walls continued rocking to and fro in the frightfullest manner, opening in several places; large stones falling down on every side from the cracks, and the ends of most of the rafters starting out from the roof. To add to this terrifying scene, the sky in a moment became so gloomy that I could now distinguish no particular object; it was an Egyptian darkness indeed, such as might be felt; owing, no doubt, to the prodigious clouds of dust and lime raised from so violent a concussion, and, as some reported, to sulphureous exhalations, but this I cannot affirm; however, it is certain I found myself almost choked for near ten minutes.

As soon as the gloom began to disperse, and the violence of the shock seemed pretty much abated, the first object I perceived in the room was a woman sitting on the floor with an infant in her arms, all covered with dust, pale and trembling. I asked her how she got hither, but her consternation was so great she could give me no account of her escape. I suppose that when the tremor first began, she ran out of her own house, and finding herself in such imminent danger from the falling stones, retired into the door of mine, which was almost contiguous to hers, for shelter, and when the shock increased, which filled the door with dust and rubbish, ran upstairs into my apartment, which was then open, be it as it might, this was no time for curiosity. I remember the poor creature asked me, in the utmost agony, if I did not think the world was at an end; at the same time she complained of being choked, and begged, for God's sake, I would procure her a little drink. Upon this I went to a closet where I kept a large jar of water (which you know is sometimes a pretty scarce commodity in Lisbon), but finding it broken in pieces, I told her she must not now think of quenching her thirst but saving her life, as the house was just falling on our heads, and if a second shock came, would certainly bury us both. I bade her take hold of my arm, and that I would endeavour to bring her into some place of security.

I shall always look upon it as a particular providence that I happened on this occasion to be undressed; for had I dressed myself as proposed when I got out of bed, in order to breakfast with a friend, I should, in all probability, have run into the street at the beginning of the shock, as the rest of the people in the house did, and, consequently, have had my brains dashed out, as every one of them had. However, the imminent danger I was in did not hinder me from considering that my present dress, only a gown and slippers, would render my getting over the ruins almost impracticable; I had, therefore, still presence of mind enough left to put on a pair of shoes and a coat, the first that came in my way, which was everything I saved, and in this dress I hurried down stairs, the woman with me, holding by my arm, and made directly to that end of the street which opens to the Tagus. Finding the passage this way entirely blocked up with the fallen houses to the height of their second storeys, I turned back to the other end which led into the main street (the common thoroughfare to the palace), having helped the woman over a vast heap of ruins, with no small hazard to my own life. Just as we were going into this street, as there was one part I could not well climb over without the assistance of my hands as well as feet, I desired her to let go her hold, which she did, remaining two or three feet behind me, at which instant there fell a vast stone from a tottering wall, and crushed both her and the child in pieces. So dismal a spectacle at any other time would have affected me in the highest degree; but the dread I was in of sharing the same fate myself, and the many instances of the same kind which presented themselves all around, were too shocking to make me dwell a moment on this single object.

I had now a long narrow street to pass, with the houses on each side four or five storeys high, all very old, the greater part already thrown down, or continually falling, and threatening the passengers with inevitable death at every step, numbers of whom lay killed before me, or what I thought far more deplorable—so bruised and wounded that they could not stir to help themselves. For my own part, as destruction appeared to me unavoidable, I only wished I might be made an end of at once, and not have my limbs broken, in which case I could expect nothing else but to be left upon the spot, lingering in misery, like these poor unhappy wretches, without receiving the least succour from any person.

As self-preservation, however, is the first law of nature, these sad thoughts did not so prevail as to make me totally despair. I proceeded on as fast as I conveniently could, though with the utmost caution; and having at length got clear of this horrid passage, I found myself safe and unhurt in the large open space before St. Paul's Church, which had been thrown down a few minutes before, and buried a great part of the congregation, that was generally pretty numerous, this being reckoned one of the most populous parishes in Lisbon. Here I stood some time, considering what I should do, and not thinking myself safe in this situation, I came to the resolution of climbing over the ruins of the west end of the church, in order to get to the river's side, that I might be removed as far as possible from the tottering houses, in case of a second shock.

This, with some difficulty, I accomplished; and here I found a prodigious concourse of people of both sexes, and of all ranks and conditions, among whom I observed some of the principal canons of the patriarchal church, in their purple robes and rochets, as these all go in the habit of bishops; several priests who had run from the altars in their sacerdotal vestments in the midst of their celebrating mass; ladies half dressed, and some without shoes; all these, whom their mutual dangers had here assembled as to a place of safety, were on their knees at prayers, with the terrors of death in their countenances, every one striking his breast and crying out incessantly *Miserecordia meu Dios.*

In the midst of these devotions the second great shock came on, little less violent than the first, and completed the ruin of those buildings which had been already much shattered. The consternation now became so universal, that the shrieks and cries of *Miserecordia* could be distinctly heard from the top of St. Catherine's Hill, at a considerable distance off, whither a vast number of people had likewise retreated; at the same time we could hear the fall of the parish church there, whereby many persons were killed on the stop and others mortally wounded. You may judge of the force of this shock when I inform you it was so violent that I could scarce keep on my knees, but it was attended with some circumstances still more dreadful than the former. On a sudden I heard a general outcry, "the sea is coming in, we shall be all lost." Upon this, turning my eyes towards the river, which in that place is near four miles broad, I could perceive it heaving and swelling in a most unaccountable manner, as no wind was stirring. In an instant there appeared, at some small distance, a large body of water, rising as it were like a mountain. It came on foaming and roaring, and rushed towards the shore with such impetuosity, that we all immediately ran for our lives as fast as possible; many were actually swept away, and the rest above their waist in water at a good distance from the banks. For my own part I had the narrowest escape, and should certainly have been lost, had I not grasped a large beam that lay on the ground, till the water returned to its channel, which it did almost at the same instant with equal rapidity. As there now appeared at least as much danger from the sea as the land, and I scarce knew whither to retire for shelter, I took a sudden resolution of returning back, with my clothes all dripping, to the area of St. Paul's. Here I stood some time, and observed the ships tumbling and tossing about as in a violent storm; some had broken their cables, and were carried to the other side of the Tagus; others were whirled round with incredible swiftness; several large boats were turned keel upwards; and all this without any wind, which seemed the more astonishing. It was at the time of which I am now speaking, that the fine new quay, built entirely of rough marble, at an immense expense, was entirely swallowed up, with all the people on it who had fled thither for safety, and had reason to think themselves out of danger in such a place: at the same time, a great number of boats and small vessels anchored near it, all likewise full of people who had retired thither for the same purpose, were all swallowed up as in a whirlpool, and never more appeared.

This last dreadful incident I did not see with my own eyes, as it passed two or three stones' throws from the spot where I then was, but I had the account as here given from several masters of ships, who were anchored within two or three hundred yards of the quay, and saw the whole catastrophe. One of them, in particular, informed me that when the second shock came on, he could perceive the *whole* city waving backwards and forwards, like the sea when the wind first begins to rise; that the agitation of the earth was so great even under the river, that it threw up his large anchor from the mooring, which swam, as he termed it, on the surface of the water; that immediately upon this extraordinary concussion, the river rose at once near twenty feet and in a moment subsided; at which instant he saw the quay, with the whole concourse of people upon it, sink down, and at the same time every one of the boats and vessels that were near it were drawn into the cavity, which he supposes instantly closed upon them, inasmuch as not the least sign of a wreck was ever seen afterwards. This account you may give full credit to, for as to the loss of the vessels, it is confirmed by everybody; and with regard to the quay, I went myself a few days after to convince myself of the truth, and could not find even the ruins of a place, where I had taken so many agreeable walks, as this was the common rendezvous of the factory in the cool of the evening. I found it all deep water, and in some parts scarcely to be fathomed.

This is the only place I could learn which was swallowed up in or about Lisbon, though I saw many large cracks and fissures in different parts; and one odd phenomenon I must not omit, which was communicated to me by a friend who has a house and wine-cellars on the other side of the river, viz., that the dwelling-house being first terribly shaken, which made all the family run out, there presently fell down a vast high rock near it; that upon this the river rose and subsided in the manner already mentioned, and immediately a great number of small fissures appeared in several contiguous pieces of ground, from whence there spouted out, like a *jet d'eau*, a large quantity of fine white sand to a prodigious height. It is not to be doubted the bowels of the earth must have been excessively agitated to cause these surprising effects; but whether the shocks were owing to any sudden explosion of various minerals mixing together, or to air pent up, and struggling for vent, or to a collection of subterraneous waters forcing a passage, God only knows. As to the fiery eruptions then talked of, I believe they are without foundation, though it is certain, I heard several complaining of strong sulphureous smells, a dizziness in their heads, a sickness in their stomachs, and difficulty of respiration, not that I felt any such symptoms myself.

Earthquake at Lisbon.—(*Continued.*)

I had not been long in the area of St. Paul's, when I felt the third shock. Though somewhat less violent than the two former, the sea rushed in again, and retired with the same rapidity, and I remained up to my knees in water, though I had gotten upon a small eminence at some distance from the river, with the ruins of several intervening houses to break its force. At this time I took notice the waters retired so impetuously, that some vessels were left quite dry, which rode in seven fathoms' water; the river thus continued alternately rushing on and retiring several times together, in such sort, that it was justly dreaded Lisbon would now meet the same fate which a few years before had befallen the city of Lima; and no doubt had this place lain open to the sea, and the force of the waves not been somewhat broken by the winding of the bay, the lower parts of it at least would have been totally destroyed.

I was now in such a situation, that I knew not which way to turn myself; if I remained there, I was in danger from the sea; if I retired further from the shore, the houses threatened certain destruction; and, at last, I resolved to go to the Mint, which being a low and very strong building, had received no considerable damage, except in some of the apartments towards the river. The party of soldiers, which is every day set there on guard, had all deserted the place, and the only person that remained was the commanding officer, a nobleman's son, of about seventeen or eighteen years of age, whom I found standing at the gate. As there was still a continued tremor of the earth, and the place where we now stood (being within twenty or thirty feet of the opposite houses, which were all tottering) appeared too dangerous, the court-yard likewise being full of water, we both retired inward to a hillock of stones and rubbish: here I entered into conversation with him, and having expressed my admiration that one so young should have the courage to keep his post, when every one of his soldiers had deserted theirs, the answer he made was, though he were sure the earth would open and swallow him up, he scorned to think of flying from his post. In short, it was owing to the magnanimity of this young man that the Mint, which at this time had upwards of two millions of money in it, was not robbed; and indeed I do him no more than justice in saying, that I never saw any one behave with equal serenity and composure, on occasions much less dreadful than the present. I believe I might remain in conversation with him near five hours; and though I was now grown faint from the constant fatigue I had undergone, and having not yet broken my fast, yet this had not so much effect upon me as the anxiety I was under for a particular friend, with whom I was to have dined that day, and who, lodging at the top of a very high house in the heart of the city, and being a stranger to the language, could not but be in the utmost danger; my concern, therefore, for his preservation, made me determine, at all events, to go and see what was become of him, upon which I took my leave of the officer.

As I thought it would be the height of rashness to venture back through the same narrow street I had so providentially escaped from, I judged it safest to return over the ruins of St. Paul's to the river side, as the water now seemed little agitated. From hence I proceeded, with some hazard, to the large space before the Irish convent of Corpo Santo, which had been thrown down, and buried a great number of people who were hearing mass, besides some of the friars; the rest of the community were standing in the area, looking, with dejected countenances, towards the ruins: from this place I took my way to the back street leading to the palace, leaving the ship-yard on one side, but found the further passage, opening into the principal street stopped up by the ruins of the Opera House, one of the solidest and most magnificent buildings of the kind in Europe, and just finished at a prodigious expense; a vast heap of stones, each of several tons' weight, had entirely blocked up the front of Mr. Bristow's house, which was opposite to it, and Mr. Ward, his partner, told me the next day, that he was just that instant going out at the door, and had actually set one foot over the threshold, when the west end of the Opera House fell down, and had he not in a moment started back, he should have been crushed into a thousand pieces.

The nobility, gentry, and clergy, who were assisting at divine service when the earthquake began, fled away with the utmost precipitation, every one where his fears carried him, leaving the splendid apparatus of the numerous altars to the mercy of the first comer; but this did not so much affect me, as the distress of the poor animals, who seemed sensible of their hard fate; some few were killed, others wounded, but the greater part, which had received no hurt, were left there to starve.

From this square, the way led to my friend's lodgings through a long, steep, and narrow street; the new scenes of horror I met with here exceed all description; nothing could be heard but sighs and groans; I did not meet with a soul in the passage who was not bewailing the death of his nearest relations and dearest friends, or the loss of all his substance; I could hardly take a single step, without treading on the dead or the dying: in some places lay coaches, with their masters, horses, and riders, *almost* crushed in pieces; here mothers with infants in their arms: there ladies richly dressed, priests, friars, gentlemen, mechanics, either in the same condition, or just expiring; some had their backs or thighs broken, others vast stones on their breasts; some lay almost buried in the rubbish, and crying out in vain to the passengers for succour, were left to perish with the rest.

At length I arrived at the spot opposite to the house where my friend, for whom I was so anxious, resided; and finding this as well as the contiguous buildings thrown down (which made me give him over for lost), I now thought of nothing but saving my own life in the best manner I could, and in less than an hour got to a public-house, kept by one Morley, near the English burying-ground, about half a mile from the city, where I still remain, with a great number of my countrymen, as well as Portuguese, in the same wretched circumstances, having almost ever since lain on the ground, and never once within doors, with scarcely any covering to defend me from the inclemency of the night air, which, at this time is exceedingly sharp and piercing.

Perhaps you may think the present doleful subject here concluded; but, alas! the horrors of the 1st of November are sufficient to fill a volume. As soon as it grew dark, another scene presented itself little less shocking than those already described: the whole city appeared in a blaze, which was so bright that I could easily see to read by it. It may be said without exaggeration, it was on fire at least in a hundred different places at once, and thus continued burning for six days together, without intermission, or the least attempt being made to stop its progress.

It went on consuming everything the earthquake had spared, and the people were so dejected and terrified, that few or none had courage enough to venture down to save any part of their substance; every one had his eyes turned towards the flames, and stood looking on with silent grief, which was only interrupted by the cries and shrieks of women and children calling on the saints and angels for succour, whenever the earth began to tremble, which was so often this night, and indeed I may say ever since, that the tremors, more or less, did not cease for a quarter of an hour together.

But what would appear incredible to you, were the fact less public and notorious, is, that a gang of hardened villains, who had been confined, and got out of prison when the wall fell, at the first shock, were busily employed in setting fire to those buildings which stood some chance of escaping the general destruction. I cannot conceive what could have induced them to this hellish work, except to add to the horror and confusion, that they might, by this means, have the better opportunity of plundering with security. But there was no necessity for taking this trouble, as they might certainly have done their business without it, since the whole city was so deserted before night, that I believe not a soul remained in it, except those execrable villains, and others of the same stamp.

The whole number of persons that perished, including those who were burnt, or afterwards crushed to death whilst digging in the ruins, is supposed, on the lowest calculation, to amount to more than sixty thousand; and though the damage in other respects cannot be computed, yet you may form some idea of it, when I assure you that this extensive and opulent city is now nothing but a vast heap of ruins; that the rich and poor are at present upon a level; some thousands of families which but the day before had been easy in their circumstances, being now scattered about in the fields, wanting every conveniency of life, and finding none able to relieve them.

Thus, my dear friend, have I given you a genuine, though imperfect account of this terrible judgment, which has left so deep an impression on my mind, that I shall never wear it off. I have lost all the money I had by me, and have saved no other clothes than what I have on my back; but what I regret most, is the irreparable loss of my books and papers. To add to my present distress, those friends to whom I could have applied on any other occasion, are now in the same wretched circumstances with myself. However, notwithstanding all that I have suffered, I do not think I have reason to despair, but rather to return my gratefullest acknowledgments to the Almighty, who hath so visibly preserved my life amidst such dangers, where so many thousands perished; and the same good Providence, I trust, will still continue to protect me, and point out some means to extricate myself out of these difficulties.

God's Care for the Small as well as for the Great.—(Chalmers.)

About the time of the invention of the telescope, another instrument was formed which laid open a scene no less wonderful. This was the microscope. The one leads me to see a system in every star. The other leads me to see a world in every atom. The one taught me that this mighty globe, with the whole burden of its people and of its countries, is but a grain of sand on the high field of immensity. The other teaches me that every grain of sand may harbour within it the tribes and the families of a busy population. The one told me of the insignificance of the world I tread upon. The other redeems it from all its insignificance; for it tells me that in the leaves of every forest, and in the flowers of every garden, and in the waters of every rivulet, there are worlds teeming with life, and numberless as are the glories of the firmament. The one has suggested to me that beyond and above all that is visible to man, there may lie fields of creation which sweep immeasurably along, and carry the impress of the Almighty's hand to the remotest scenes of the universe. The other suggests to me, that within and beneath all that minuteness which the aided eye of man has been able to explore, there may lie a region of invisibles; and that could we draw aside the mysterious curtain which shrouds it from our senses, we might there see a theatre of as many wonders as astronomy has unfolded, a universe within the compass of a point so small as to elude all the powers of the microscope, but where the wonder-working God finds room for the exercise of all His attributes, where He can raise another mechanism of worlds, and fill and animate them all with the evidences of His glory.

By the telescope we have discovered that no magnitude, however vast, is beyond the grasp of the Divinity. But by the microscope we have also discovered that no minuteness, however shrunk from the notice of the human eye, is beneath the condescension of His regard. Every addition to the powers of the one instrument extends the limit of His visible dominions. But by every addition to the powers of the other instrument, we see each part of them more crowded than before with the wonders of His unwearying hand. The one is constantly widening the circle of His territory. The other is as constantly filling up its separate portions with all that is rich and various and exquisite. In a word, by the one I am told that the Almighty is now at work in regions more distant than geometry has ever measured, and among worlds more manifold than numbers have ever reached. But by the other I am also told, that with a mind to comprehend the whole, in the vast compass of its generality, He has also a mind to concentrate a close and a separate attention on each and on all of its particulars; and that the same God who sends forth an upholding influence among the orbs and the movements of astronomy, can fill the recesses of every single atom with the intimacy of His presence, and travel in all the greatness of His unimpaired attributes, upon every one spot and corner of the universe He has formed. They, therefore, who think that God will not put forth such a power, and such a goodness, and such a condescension in behalf of this world, as are ascribed to Him in the New Testament, because He has so many other worlds to attend to, think of Him as a man. They confine their view to the informations of the telescope, and forget altogether the informations of the other instrument. They only find room in their minds for His one attribute of a large and general superintendence, and keep out of their remembrance the equally impressive proofs we have of His other attribute, of a minute and multiplied attention to all that diversity of operations where it is He that worketh all in all. And when I think that as one of the instruments of philosophy has heightened our every impression of the first of these attributes, so another instrument has no less heightened our impression of the second of them—then I can no longer resist the conclusion, that it would be a transgression of sound argument, as well as a daring of impiety, to draw a limit around the doings of this unsearchable God—and should a professed revelation from Heaven tell me of an act of condescension in behalf of some separate world, so wonderful that angels desired to look into it, and the Eternal Son had to move from His seat of glory to carry it into accomplishment, all I ask is the evidence of such a revelation; for let it tell me as much as it may of God letting himself down for the benefit of one single province of His dominions, this is no more than what I see lying scattered in numberless examples before me, and running through the whole line of my recollections, and meeting me in every walk of observation to which I can betake myself; and now that the microscope has unveiled the wonders of another region, I see strewed around me, with a profusion which baffles my every attempt to comprehend it, the evidence that there is no one portion of the universe of God too minute for His notice or too humble for the visitations of His care.

TRACES OF OCEAN.—(HUGH MILLER.)

WAS it the sound of the distant surf that was in mine ears, or the low moan of the breeze, as it crept through the neighbouring wood? Oh, that hoarse voice of Ocean, never silent since time first began—where has it not been uttered! There is stillness amid the calm of the arid and rainless desert, where no spring rises and no streamlet flows, and the long caravan plies its weary march amid the blinding glare of the sand, and the red unshaded rays of the fierce sun. But once and again, and yet again, has the roar of Ocean been there. It is *his* sands that the winds heap up; and it is the skeleton remains of his vassals—shells and fish, and the stony coral—that the rocks underneath enclose. There is silence on the tall mountain peak, with its glittering mantle of snow, where the panting lungs labour to inhale the thin bleak air; where no insect murmurs and no bird flies, and where the eye wanders over multitudinous hill-tops that lie far beneath, and vast dark forests that sweep on to the distant horizon, and along long hollow valleys where the great rivers begin. And yet once and again, and yet again, has the roar of Ocean been there. The elegies of his more ancient denizens we find sculptured on the crags, where they jut from beneath the ice into the mist-wreath; and his later beaches, stage beyond stage, terrace the descending slopes. Where has the great destroyer not been—the devourer of continents, the blue foaming dragon—whose vocation it is to eat up the land? His ice-floes have alike furrowed the flat steppes of Siberia and the rocky flanks of Schehallion; and his nummulites and fish lie imbedded in great stones of the pyramids, hewn in the times of the old Pharaohs, and in rocky folds of Lebanon still untouched by the tool. So long as Ocean exists there must be disintegration, dilapidation, change; and should the time ever arrive when the elevatory agencies, motionless and chill, shall sleep within their profound depths to awaken no more, and should the sea still continue to impel its currents and to roll its waves, every continent and island would at length disappear, and again, as of old, "when the fountains of the great deep were broken up,"

"A shoreless ocean tumble round the globe."

Was it with reference to this principle, so recently recognised, that we are so expressly told in the Apocalypse respecting the renovated earth, in which the state of things shall be fixed and eternal, that "there shall be no more sea?" or are we to regard the revelation as the mere hieroglyphic, the pictured shape, of some analogous moral truth? "Reasoning from what we know,"—and what else remains to us!—an earth without a sea would be an earth without rain, without vegetation, without life—a dead and doleful planet of waste places, such as the telescope reveals to us in the moon. And yet the Ocean does seem peculiarly a creature of time, of all the great agents of vicissitude and change the most influential and untiring; and to a state in which there shall be no vicissitude and no change, in which the earthquake shall not heave from beneath, nor the mountains wear down and the continents melt away, it seems inevitably necessary that there should be "no more sea."

Industry.—(Clarendon.)

There is no art or science that is too difficult for industry to attain to; it is the gift of tongues, and makes a man understood and valued in all countries and by all nations; it is the philosopher's stone that turns all metals, and even stones, into gold, and suffers not want to break into its dwelling; it is the north-west passage, that brings the merchant's ship as soon to him as he can desire. In a word, it conquers all enemies, and makes fortune itself pay contribution.

Energy.—(Sir T. F. Buxton.)

The longer I live, the more I am certain that the great difference between men, between the feeble and the powerful, the great and the insignificant, is energy, invincible determination. A purpose once fixed, and then death or victory. That quality will do anything that can be done in this world; and no talents, no circumstances, no opportunities, will make a two-legged animal a man without it.

On Fame.—(Oliver Goldsmith.)

An alehouse keeper near Islington, who had long lived at the sign of the French King, upon the commencement of the last war with France, pulled down his old sign and put up the Queen of Hungary. Under the influence of her red face and golden sceptre, he continued to sell ale till she was no longer the favourite of his customers; he changed her, therefore, some time ago, for the King of Prussia, who may probably be changed in turn for the next great man that shall be set up for vulgar admiration. . . . . I must own I have such an indifferent opinion of the vulgar, that I am ever led to suspect that merit which raises their shout; at least I am certain to find those great, and sometimes good men, who find satisfaction in such acclamations, made worse by it; and history has too frequently taught me that the head which has grown this day giddy with the roar of the million, has the very next been fixed upon a pole. As Alexander VI. was entering a little town in the neighbourhood of Rome, which had been just evacuated by the enemy, he perceived the townsmen busy in the market-place in pulling down from a gibbet a figure which had been designed to represent himself. There were also some knocking down a neighbouring statue of one of the Orsini family, with whom he was at war, in order to put Alexander's effigy, when taken down, in its place. It is possible a man who knew less of the world would have condemned the adulation of these barefaced flatterers; but Alexander seemed pleased at their zeal, and turning to Borgia his son, he said with a smile, "You see, my son, the small difference between a gibbet and a statue." If the great could be taught any lesson, this might serve to teach them upon how weak a foundation their glory stands which is built upon popular applause; for, as such praise what seems like merit, they as quickly condemn what has only the appearance of guilt.

Popular glory is a perfect coquette; her lovers must toil, feel every inquietude, indulge every caprice, and perhaps at last be jilted into the bargain. True glory, on the other hand, resembles a woman of sense; her admirers must play no tricks; they feel no great anxiety, for they are sure in the end of being rewarded in proportion to their merit. . . .

I know not how to turn so trite a subject out of the beaten road of commonplace, except by illustrating it, rather by the assistance of my memory than my judgment, and instead of making reflections, by telling a story.

A Chinese, who had long studied the works of Confucius, who knew the characters of fourteen thousand words, and could read a great part of every book that came in his way, once took it into his head to travel into Europe and observe the customs of a people whom he thought not very much inferior even to his own countrymen in the arts of refining upon every pleasure. Upon his arrival at Amsterdam, his passion for letters naturally led him to a bookseller's shop; and as he could speak a little Dutch, he civilly asked the bookseller for the works of the immortal Ilixifou. The bookseller assured him he had never heard the book mentioned before. "What! have you never heard of that immortal poet?" returned the other, much surprised, "that light of the eyes, that favourite of kings, that rose of perfection! I suppose you know nothing of the immortal Fipsihihi, second cousin to the moon?" "Nothing at all indeed, sir," returned the other. "Alas!" cries our traveller, "to what purpose then, has one of these fasted to death, and the other offered himself up as a sacrifice to the Tartarean enemy to gain a renown which has never travelled beyond the precincts of China?"

There is scarcely a village in Europe, and not one university, that is not thus furnished with its little great men. The head of a petty corporation who opposes the designs of a prince who would tyrannically force his subjects to save their best clothes for Sunday; the puny pedant who finds one undiscovered property in the polype, describes an unheeded process in the skeleton of a mole, and whose mind, like his microscope, perceives nature only in detail; the rhymer who makes smooth verses, and paints to our imagination when he should only speak to our hearts; all equally fancy themselves walking forward to immortality, and desire the crowd behind them to look on. The crowd takes them at their word; patriot, philosopher, and poet, are shouted in their train. Where was there ever so much merit seen? No times so important as our own! Ages yet unborn shall gaze with wonder and applause! To such music the important pigmy moves forward, bustling and swelling, and aptly compared to a *puddle in a storm.*

OF TRUTH.—(BACON.[1])

TRUTH, which only doth judge itself, teacheth that the inquiry of truth, which is the love-making, or wooing of it—the knowledge of truth, which is the presence of it—and the belief of truth, which is the enjoying of it—is the sovereign good of human nature. The first creature of God, in the works of the days, was the light of the sense, the last was the light of reason, and his Sabbath work, ever since, is the illumination of his spirit. First he breathed light upon the face of the matter, or chaos, then he breathed light into the face of man, and still he breatheth and inspireth light into the face of his chosen. The poet that beautified the sect, that was otherwise inferior to the rest, saith yet excellently well, "It is a pleasure to stand upon the shore, and to see ships tost upon the sea; a pleasure to stand in the window of a castle, and to see a battle, and the adventures thereof below; but no pleasure is comparable to the standing upon the vantage ground of truth (a hill not to be commanded, and where the air is always

late," wrote the Papal Nuncio, "and the decision is not yet known. The judges and the culprits have gone to their own homes. The jury remain together. To-morrow we shall learn the event of this great struggle."

The solicitor for the bishops sat up all night with a body of servants on the stairs leading to the room where the jury was consulting. It was absolutely necessary to watch the officers who watched the doors; for those officers were supposed to be in the interest of the crown, and might, if not carefully observed, have furnished a courtly juryman with food, which would have enabled him to starve out the other eleven. Strict guard was therefore kept. Not even a candle to light a pipe was permitted to enter.

There is no vice th water for washing were suffered to pass at about

found false and perfidious; and therefore Montaigne saith prettily,

[1] Born 1561.

when he inquired the reason why the word of the lie should be such a disgrace, and such an odious charge, "If it be well weighed, to say that a man lieth, is as much as to say that he is brave towards God, and a coward towards men: for a lie faces God, and shrinks from man." Surely the wickedness of falsehood and breach of faith cannot possibly be so highly expressed as in that it shall be the last peal to call the judgments of God upon the generations of men: it being foretold, that when "Christ cometh," he shall not "find faith upon earth."

Of Studies.—(Bacon.)

Studies serve for delight, for ornament, and for ability. Their chief use for delight is in privateness and retiring; for ornament, in discourse; and for ability, in the judgment and disposition of business. For *expert* men can execute, and perhaps judge of particulars, one by one; but the general counsels, and the plots and marshalling of affairs, come best from those that are *learned.* To spend too much time in studies is sloth; to use them too much for ornament is affectation; to make judgment wholly by their rules is the humour of a scholar. They perfect nature, and are perfected by experience, for natural abilities are like natural plants that need pruning by study; and studies themselves do give forth directions too much at large, except they be bounded in by expe-
to death, and the other offered himself up as a sacrifice to the Tartarean enemy to gain a renown which has never travelled beyond the precincts of China?"

There is scarcely a village in Europe, and not one university, that is not thus furnished with its little great men. The head of a petty corporation who opposes the designs of a prince who would tyrannically force his subjects to save their best clothes for Sunday; the puny pedant who finds one undiscovered property in the polype, describes an unheeded process in the skeleton of a mole, and whose mind, like his microscope, perceives nature only in detail; the rhymer who makes smooth verses, and paints to our imagination when he should only speak to our hearts; all equally fancy themselves walking forward to . Reading maketh a full man; conference a ready man; and writing an exact man; and therefore, if a man write little, he had need have a great memory; if he confer little, he had need have a present wit; and if he read little, he had need have much cunning to seem to know that he doth not. Histories make men wise; poets witty; the mathematics subtle; *natural* philosophy deep; *moral* grave; logic and rhetoric able to contend. Studies exercise influence upon the morals; nay, there is no *stond* or impediment in the wit, but may be wrought out by fit studies; like as diseases of the body may have appropriate exercises. Bowling is good for the stone and reins; shooting for the lungs and breast; gentle walking for the stomach; riding for the head; and the like. So if a man's wit be wandering, let him study the mathematics; for in demonstrations, if his wit be called away never so little, he must begin again; if his wit be not apt to distinguish or find difference, let him study the schoolmen, for they are hair-splitters; if he be not apt to beat over matters, and to call up one thing to prove and illustrate another, let him study the lawyer's cases. So every defect of the mind may have a special receipt.

THE ACQUITTAL OF THE BISHOPS.—(MACAULAY.)

IT was dark before the jury retired to consider of their verdict. The night was a night of intense anxiety. Some letters are extant which were despatched during that period of suspense, and which have therefore an interest of a peculiar kind. "It is very late," wrote the Papal Nuncio, "and the decision is not yet known. The judges and the culprits have gone to their own homes. The jury remain together. To-morrow we shall learn the event of this great struggle."

The solicitor for the bishops sat up all night with a body of servants on the stairs leading to the room where the jury was consulting. It was absolutely necessary to watch the officers who watched the doors; for those officers were supposed to be in the interest of the crown, and might, if not carefully observed, have furnished a courtly juryman with food, which would have enabled him to starve out the other eleven. Strict guard was therefore kept. Not even a candle to light a pipe was permitted to enter. Some basins of water for washing were suffered to pass at about four in the morning. The jurymen, raging with thirst, soon lapped up the whole. Great numbers of people walked the neighbouring streets till dawn. Every hour a messenger came from Whitehall to know what was passing. Voices, high in altercation, were repeatedly heard within the room; but nothing certain was known.

At first, nine were for acquitting and three for convicting. Two of the minority soon gave way, but Arnold was obstinate. Thomas Austin, a country gentleman of great estate, who had paid close attention to the evidence and speeches, and had taken full notes, wished to argue the question. Arnold declined. He was not used, he doggedly said, to reasoning and debating. His conscience was not satisfied, and he should not acquit the bishops. "If you come to that," said Austin, "look at me; I am the largest and strongest of the twelve, and before I find such a petition as this a libel, here I will stay till I am no bigger than a tobacco-pipe. It was six in the morning before Arnold yielded. It was soon known that the jury were agreed, but what the verdict would be was still a secret.

At ten the court again met. The crowd was greater than ever. The jury appeared in their box, and there was a breathless stillness.

Sir Samuel Astry spoke, "Do you find the defendants, or any of them, guilty of the misdemeanour whereof they are impeached, or not guilty?" Sir Roger Langley answered, "Not guilty." As the words passed his lips, Halifax sprung up and waved his hat. At that signal, benches and galleries raised a shout. In a moment ten thousand persons, who crowded the great hall, replied with a still louder shout, which made the old oaken roof crack; and in another moment the innumerable throng without set up a third huzza, which was heard at Temple Bar. The boats which covered the Thames gave an answering cheer. A peal of gunpowder was heard on the water, and another, and another; and so, in a few moments, the glad tidings went flying past the Savoy and the Friars to London Bridge, and to the forest of masts below.

As the news spread, streets and squares, market-places, and coffee-houses, broke forth into acclamations. Yet were the acclamations less strange than the weeping. For the feelings of men had been wound up to such a point that at length the stern English nature, so little used to outward signs of emotion, gave way, and thousands sobbed for very joy. Meanwhile, from the outskirts of the multitude, horsemen were spurring off to bear along the great roads intelligence of the victory of our church and nation. Yet not even that astounding explosion could awe the bitter and intrepid spirit of the solicitor. Striving to make himself heard above the din, he called on the judges to commit those who had violated, by clamour, the dignity of a court of justice. One of the rejoicing populace was seized; but the tribunal felt it would be absurd to punish a single individual for an offence common to hundreds of thousands, and dismissed him with a gentle reprimand.

The acquitted prelates took refuge from the crowd which implored their blessing in the nearest chapel where divine service was performing. Many churches were open on that morning throughout the capital, and many pious persons repaired thither. The bells of all the parishes of the city and liberties were ringing. The jury, meanwhile, could scarcely make their way out of the hall. They were forced to shake hands with hundreds. "God bless you," cried the people; "God prosper your families; you have done like honest, good-natured gentlemen. You have saved us to-day." As the gentlemen who had supported the cause drove off, they flung from their windows handfuls of money, and bade the crowd drink to the health of the bishops and the jury.

The attorney went with the tidings to Sunderland, who happened to be conversing with the Nuncio. "Never," said Powis, "within man's memory, have there been such shouts and such tears of joy as to-day." The king had that morning visited the camp on Hounslow Heath. Sunderland instantly sent a courier thither with the news. James was in Lord Feversham's tent when the express arrived. He was greatly disturbed, and exclaimed in French, "So much the worse for them!" He soon set out for London.

While he was present, respect prevented the soldiers from giving loose to their feelings; but he had scarcely quitted the camp when he heard a great shouting behind him. He was surprised, and asked what the uproar meant. "Nothing," was the answer. "The soldiers are glad that the bishops are acquitted." "Do you call that nothing?" said James, and then repeated, "So much the worse for them." He might well be out of temper. His defeat had been complete and most humiliating. Had the prelates escaped on account of some technical defect in the case for the crown, had they escaped because they had not written the petition in Middlesex, or because it was impossible to prove, according to the strict rules of law, that they had delivered to the king the paper for which they were called in question, the prerogative would have suffered no shock. Happily for the country, the fact of publication had been fully established. The counsel for the defence had therefore been forced to attack the dispensing power. They had attacked it with great learning, eloquence, and boldness. The advocates of the Government had been, by universal acknowledgment, overmatched in the contest. Not a single judge had ventured to declare that the Declaration of Indulgence was legal. One judge had in the strongest terms pronounced it illegal. The language of the whole town was, that the dispensing power had received a fatal blow.

Speech of Lord Chatham against the American War, and the employment of the Indians in it.

I cannot, my lords, I will not, join in congratulation on misfortune and disgrace. This, my Lords, is a perilous and tremendous moment. It is not a time for adulation: the smoothness of flattery cannot save us in this rugged and awful crisis. It is now necessary to instruct the throne in the language of truth. We must, if possible, dispel the delusion and darkness which envelop it, and display, in its full danger and genuine colours, the ruin which is brought to our doors. Can ministers still presume to expect support in their infatuation? Can Parliament be so dead to its dignity and duty, as to give their support to measures thus obtruded and forced upon them? Measures, my lords, which have reduced this late flourishing empire to scorn and contempt! "But yesterday, and Britain might have stood against the world; now, none so poor as to do her reverence." The people, whom we at first despised as rebels, but whom we now acknowledge as enemies, are abetted against us, supplied with every military store, have their interest consulted, and their ambassadors entertained, by our inveterate enemy; and ministers do not, and dare not, interpose with dignity or effect. The desperate state of our army abroad is in part known. No man more highly esteems and honours the British troops than I do; I know their virtues and their valour; I know they can achieve anything but impossibilities; and I know that the conquest of British America is an impossibility. You cannot, my lords, you cannot conquer America. What is your present situation there? We do not know the *worst;* but we know that in three campaigns we have done nothing and suffered much. You may swell every expense, accumulate every assistance, and extend your traffic to the shambles of every German despot: your attempts will be for ever vain and impotent—doubly so, indeed, from this mercenary aid on which you rely, for it irritates, to an incurable resentment, the minds of your adversaries, to overrun them with the mercenary sons of rapine and plunder, devoting them and their possessions to the rapacity of hireling cruelty. If I were an American as I am an Englishman, while a foreign troop was landed in my country, I never would lay down my arms—*never, never, never!*

But, my lords, who is the man that, in addition to the disgraces and mischiefs of the war, has dared to authorize and associate to our arms the tomahawk and scalping-knife of the savage? to call into civilized alliance, the wild and inhuman inhabitants of the woods? to delegate to the merciless Indian the defence of disputed rights, and to wage the horrors of his barbarous war against our brethren? My lords, these enormities cry aloud for redress and punishment. But, my lords, this barbarous measure has been defended, not only on the principles of policy and necessity, but also on those of morality; "for it is perfectly allowable," says Lord Suffolk, "to use all the means which God and nature have put into our hands." I am astonished, I am shocked, to hear such principles confessed; to hear them avowed in this House, or in this country. My lords, I did not intend to encroach so much on your attention, but I cannot repress my indignation—I feel myself impelled to speak. My lords, we are called upon as members of this House, as men, as Christians, to protest against such horrible barbarity!—"That God and nature have put into our hands!" What ideas of God and nature that noble Lord may entertain, I know not; but I know that such detestable principles are equally abhorrent to religion and humanity. What! to attribute the sacred sanction of God and nature to the massacres of the Indian scalping-knife! to the cannibal savage, torturing, murdering, devouring, drinking the blood of his mangled victims! Such notions shock every precept of morality, every feeling of humanity, every sentiment of honour. These abominable principles, and this more abominable avowal of them, demand the most decisive indignation.

I call upon that right reverend, and this most learned bench, to vindicate the religion of their God, to support the justice of their country. I call upon the Bishops to interpose the unsullied sanctity of their lawn; upon the Judges to interpose the purity of their ermine, to save us from this pollution. I call upon the honour of your lordships to reverence the dignity of your ancestors, and to maintain your own. I call upon the spirit and humanity of my country, to vindicate the national character. I invoke the genius of the Constitution!

My lords, I am old and weak, and at present unable to say more; but my feelings and indignation were too strong to have said less. I could not have slept this night in my bed, nor even have reposed my head upon my pillow, without giving vent to my eternal abhorrence of such enormous and preposterous principles.

Lord Brougham on Negro Slavery.

I trust that, at length, the time is come, when parliament will no longer bear to be told that slave-owners are the best lawgivers on slavery: no longer suffer our voice to roll across the Atlantic, in empty warnings and fruitless orders. Tell me not of rights—talk not of the property of the planter in his slaves. I deny his right—I acknowledge not the property. The principles, the feelings of our common nature rise in rebellion against it. Be the appeal made to the understanding or to the heart, the sentence is the same that rejects it! In vain you tell me of laws that sanction such a claim! There is a law, above all the enactments of human codes—the same, throughout the world—the same in all times: such as it was, before the daring genius of Columbus pierced the night of ages, and opened to one world the sources of power, wealth, and knowledge, to another, all utterable woes,—such is it at this day: it is the law written by the finger of God on the heart of man; and by that law, unchangeable and eternal—while men despise fraud, and loathe rapine, and hate blood—they shall reject, with indignation, the wild and guilty fantasy, that man can hold property in man!

In vain you appeal to treaties—to covenants between nations.

The covenants of the Almighty, whether the old covenant or the new, denounce such unholy pretensions. To these laws did they of old refer, who maintained the African trade. Such treaties did they cite—and not untruly; for, by one shameful compact, you bartered the glories of Blenheim for the traffic in blood. Yet, in despite of law and of treaty, that infernal traffic is now destroyed, and its votaries put to death like other pirates. How came this change to pass? Not, assuredly, by parliament leading the way: but the country at length awoke; the indignation of the people was kindled; it descended in thunder, and smote the traffic, and scattered its guilty profits to the winds. Now, then, let the planters beware—let their assemblies beware—let the government at home beware—let the parliament beware! The same country is once more awake—awake to the condition of negro slavery; the same indignation kindles in the bosom of the same people; the same cloud is gathering that annihilated the slave trade; and if it shall descend again, they on whom its crash may fall, will not be destroyed before I have warned them; but I pray, that their destruction may turn away from us the more terrible judgments of God!

Appearance of the Sky.—(Ruskin.)

It is a strange thing how little, in general, people know about the sky. It is the part of creation in which nature has done more for the sake of pleasing man, more for the sole and evident purpose of talking to him and teaching him, than in any other of her works; and it is just the part in which we least attend to her. There are not many of her other works in which some more material or essential purpose than the mere pleasing of man is not answered by every part of their organization; but every essential purpose of the sky might, so far as we know, be answered if, once in three days or thereabouts, a great, ugly, black rain-cloud were brought up over the blue, and everything well watered, and so all left blue again till next time, with, perhaps, a film of morning and evening mist for dew. And, instead of this, there is not a moment of any day of our lives when nature is not producing, scene after scene, picture after picture, glory after glory, and working still upon such exquisite and constant principles of the most perfect beauty, that it is quite certain that it is all done for us, and intended for our perpetual pleasure. And every man, wherever placed, however far from other sources of interest or of beauty, has this doing for him constantly. The noblest scenes of the earth can be seen and known but by few; it is not intended that man should live always in the midst of them; he injures them by his presence; he ceases to feel them if he be always with them. But the sky is for all; bright as it is, it is not "too bright nor good for human nature's daily food;" it is fitted, in all its functions, for the perpetual comfort and exalting of the heart; for the soothing it, and purifying it from its dross and dust. Sometimes gentle, sometimes capricious, sometimes awful; never the same for two moments together; almost human in its passions, almost spiritual in its tenderness, almost divine in its infinity, its appeal to what is immortal in us is as distinct as its ministry of chastisement or of blessing to what is mortal, is essential. And yet we never attend to it; we never make it a subject of thought, but as it has to do with our animal sensations; we look upon all by which it speaks to us more clearly than to brutes, upon all which bears witness to the intention of the Supreme, that we are to receive more from the covering vault than the light and the dew which we share with the weed and the worm, only as a succession of meaningless and monotonous accidents, too common and too vain to be worthy of a moment of watchfulness or a glance of admiration. If, in our moments of utter idleness and insipidity, we turn to the sky as a last resource, which of its phenomena do we speak of? One says it has been wet, and another it has been windy, and another it has been warm. Who, among the whole chattering crowd, can tell me of the forms and precipices of the chain of tall white mountains that gilded the horizon at noon yesterday? Who saw the narrow sunbeam that came out of the south, and smote upon their summits, until they melted and mouldered away in a dust of blue rain? Who saw the dance of the dead clouds, when the sunlight left them last night, and the west wind blew them before it, like withered leaves? All has passed unregretted or unseen; or, if the apathy be ever shaken off, even for an instant, it is only by what is gross or what is extraordinary; and yet it is not in the broad and fierce manifestations of the elemental energies, not in the clash of the hail, nor the drift of the whirlwind, that the highest characters of the sublime are developed. . . . It is in quiet and subdued passages of unobtrusive majesty; the deep, and the calm, and the perpetual; that which must be sought ere it is seen, and loved ere it is understood; things which the angels work out for us daily, and yet vary eternally, which are never wanting, and never repeated; which are to be found always, yet each found but once. It is through these that the lesson of devotion is chiefly taught, and the blessing of beauty given.

Physiognomy of Plants.—(Humboldt.)

When the active curiosity of man is engaged in interrogating Nature, or when his imagination dwells on the wide fields of organic creation, among the multifarious impressions which his mind receives, perhaps none is so strong and profound as that of the universal profusion with which life is everywhere distributed. Even on the polar ice the air resounds with the cries or songs of birds, and with the hum of insects. Nor is it only the lower dense and vaporous strata of the atmosphere which are thus filled with life, but also the higher and more ethereal regions. Whenever Mont Blanc or the summits of the Cordilleras have been ascended, living creatures have been found there. On the Chimborazo, 8000 feet higher than Etna, we found butterflies and other winged insects, borne by ascending currents of air to those almost unapproachable solitudes, which man, led by a restless curiosity or unappeasable thirst of knowledge, treads with adventurous but cautious steps: like him, strangers in those elevated regions, their presence shows us that the more flexible organization of animal creation can subsist far beyond the limits at which vegetation ceases. The condor, the giant of the vulture tribe, often soared over our heads above all the summits of the Andes, at an altitude higher than would be the Peak of Teneriffe if piled on the snow-covered crests of the Pyrenees. The rapacity of this powerful bird attracts him to these regions, whence his far-seeing eye may discern the objects of his pursuit, the soft-wooled Vicunas, which, wandering in herds, frequent, like the Chamois, the mountain pastures adjacent to the regions of perpetual snow.

We do not yet know where life is most abundant,—whether on continents or in the unfathomed depths of the ocean. Through the labours of Ehrenberg, we have seen the sphere of organic life extend, and its horizon widen before our eyes, both in the tropical parts of the ocean and in the fixed or floating masses of ice of the Antarctic seas. Silicious-shelled Polygastrica, and even Coscinodiscæ, with their green ovaries, have been found alive enveloped in masses of ice only twelve degrees from the Pole; the small black Glacier flea and Podurellæ inhabit the narrow tubular holes examined by Agassiz in the Swiss glaciers. Ehrenberg has shown that on several microscopic Infusoria others live as parasites, and that in the Gallionellæ such is their prodigious power of development, or capability of division, that in the space of four days an animalcule invisible to the naked eye can form two cubic feet of the Bilin polishing slate. In the sea, gelatinous worms living or dead, shine like stars, and by their phosphoric light change the surface of the wide ocean into a sea of fire. Ineffaceable is the impression made on my mind by the calm nights of the torrid zone, on the waters of the Pacific. I still see the dark azure of the firmament, the constellation of the Ship near the zenith, and that of the Cross declining towards the horizon, shedding through the perfumed air their soft and planetary lustre; while bright furrows of flashing light marked the tract of the dolphins through the midst of the foaming waves.

Not only the ocean, but also the waters of our marshes, hide from us an innumerable multitude of strange forms. The naked eye can with difficulty distinguish the Cyclidias, the Cuglenes, and the host of Naids divisible by branches like the Lemna or Duckweed, of which they seek the shade. Other creatures inhabit receptacles where the light cannot penetrate, and an atmosphere variously composed, but differing from that which we breathe: such are the spotted Ascaris, which lives beneath the skin of the earthworm; the Leucophra, of a bright silvery colour, in the interior of the shore Naid; and a Pentastoma, which inhabits the large pulmonary cells of the rattlesnake of the tropics. There are animalculæ in the blood of frogs and of salmon, and even, according to Nordmann, in the fluids of the eyes of fishes and in the gills of the Bleak. Thus the most hidden recesses of creation teem with life.

Turning to the vegetable world again, on the existence of which that of animals is dependent, we find that plants are incessantly engaged in disposing into order towards subsequent organization the raw materials of which the earth is composed: it is their office, by their vital forces or powers, to prepare those substances which, after undergoing a thousand modifications, are gradually converted to nobler purposes in the formation of nervous tissues. In directing our consideration towards the various families of plants, we shall at the same time glance at the multitude of animated beings to which they afford nutriment and protection.

The carpet of flowers and of verdure spread over the naked crust of our planet is unequally woven; it is thicker where the sun rises high in the ever-cloudless heavens, and thinner towards the poles, in the less happy climes where returning frosts often destroy the opening buds of spring, or the ripening fruits of autumn. Everywhere, however, man finds some plants to minister to his support and enjoyment. If new lands are formed, the organic forces are ever ready to cover the naked rock with life. Sometimes, as at an early period among the Greek islands, volcanic forces suddenly elevate above the surface of the boiling waves a rock covered with Scoriæ: sometimes, by a long-continued and more tranquil series of phenomena, the collective labours of united Lithophytes raise their cellular dwellings on the crests of submarine mountains, until, after thousands of years, the structure reaches the level of the ocean, when the creatures which have formed it die, leaving a low flat coral island. How are the seeds of plants brought so immediately to these new shores? by wandering birds, or by the winds and waves of the ocean? The distance from other coasts makes it difficult to determine this question; but no sooner is the rock of the newly-raised islands in direct contact with the atmosphere, than there is formed on its surface, in our northern countries, a soft silky net-work, appearing to the naked eye as coloured spots and patches. Some of these patches are bordered by single or double raised lines running round their margins; other patches are crossed by similar lines traversing them in various directions. Gradually the light colour of the patches becomes darker, the bright yellow which was visible at a distance changes to brown, and the bluish grey of the Leprarias becomes a dusty black. The edges of neighbouring patches approach and run into each other; and on the dark ground thus formed there appear other lichens, of a circular shape and dazzling whiteness. Thus an organic film or covering establishes itself by successive layers; and as mankind, in forming settled communities, pass through different stages of civilisation, so is the gradual propagation and extension of plants connected with determinate physical laws. Lichens form the first covering of the naked rock, where afterwards lofty forest trees rear their airy summits. The successive growth of mosses, grasses, herbaceous plants, and shrubs or bushes, occupies the intervening period of long but undetermined duration. The part which lichens and mosses perform in the northern countries is effected within the tropics by Portulacas, Gomphrenas, and other low and succulent shore plants. The history of the vegetable covering of our planet, and its gradual propagation over the desert crust of the earth, has its epochs, as well as that of the migrations of the animal world.

Yet although organic life is everywhere diffused, and the organic powers are incessantly at work in reconnecting with each other the elements set free by death or dissolution, the abundance and variety of organized beings, and the rapidity with which they are renewed, differ in different climates. In the cold zones, the activity of organic life undergoes a temporary suspension during a portion of the year by frost; fluidity is an essential condition of life or vital action, and animals and plants, with the exception of mosses and other cryptogamia, are in those regions buried for several months of each year in winter sleep. Over a large part of the earth, therefore, there could only be developed organic forms capable of supporting either a considerable diminution of heat, or, being without leaves, a long interruption of the vital functions. Thus we see variety and grace of form, mixture of colours, and generally the perpetually youthful energy and vigour of organic life, increase as we approach the tropics.

Those, therefore, who can view nature with a comprehensive glance and apart from local phenomena, may see from the poles to the equator, organic life and vigour gradually augment with the augmentation of vivifying heat. But in the course of this progressive increase there are reserved to each zone its own peculiar beauties; to the tropics, variety and grandeur of vegetable forms; to the north, the aspect of its meadows and green pastures, and the periodic reawakening of nature at the first breath of the mild air of spring. Each zone, besides its own peculiar advantages, has its own distinctive character. Primeval laws of organization, notwithstanding a certain degree of freedom in the abnormal development of single parts, bind all animal and vegetable forms to fixed ever-recurring types. As we recognise in distinct organic beings a determinate physiognomy, and as descriptive botany and zoology, in the restricted sense of the terms, consist in a detailed analysis of animal and vegetable forms, so each region of the earth has a natural physiognomy peculiar to itself. The idea indicated by the painter by expressions such as "Swiss nature," "Italian sky," &c., rests on a partial perception of this local character in the aspect of nature. The azure of the sky, the lights and shadows, the haze resting on the distance, the forms of animals, the succulency of the plants and herbage, the brightness of the foliage, the outline of the mountains, are all elements which determine the total impression characteristic of each district or region. George Forster, in the narrative of his voyages, and in his other publications,—Goethe, in the descriptions of nature which so many of his immortal works contain,—Buffon, Bernardin de St. Pierre, and Chateaubriand, have traced with inimitable truth of description the character of some of the zones into which the earth is divided. Not only do such descriptions afford us mental enjoyment of a high order, but the knowledge of the character which nature assumes in different regions is, moreover, intimately connected with the history of man and of his civilisation. For although the commencement of this civilisation is not solely determined by physical relations, yet the direction which it takes, the national character, and the more grave or gay dispositions of men, are dependent in a very high degree on climatic influences. How powerfully have the skies of Greece acted on its inhabitants! The nations settled in the fair and happy regions bounded by the Euphrates, the Halys, and the Ægean sea, also early attained amenity of manners and delicacy of sentiment. When in the middle ages religious enthusiasm suddenly re-opened the sacred East to the nations of Europe who were sinking back into barbarism, our ancestors in returning to their homes brought with them gentler manners, acquired in those delightful valleys. The poetry of the Greeks, and the ruder songs of the primitive northern nations, owe great part of their peculiar character to the aspect of the plants and animals seen by the bard, to the mountains and valleys which surrounded him, and to the air which he breathed. And to recall more familiar objects, who does not feel himself differently affected in the dark shade of the beech, on hills crowned with scattered fir-trees, or on the turfy pasture, where the wind rustles in the trembling foliage of the birch? These trees of our native land have often suggested or recalled to our minds images and thoughts, either of a melancholy, of a grave and elevating, or of a cheerful character. The influence of the physical on the moral world,—that reciprocal and mysterious action and reaction of the material and the immaterial,—gives to the study of nature, when regarded from higher points of view, a peculiar charm, still too little recognised.

Many of the enjoyments which Nature affords are wanting to the nations of the North. Many constellations, and many vegetable forms—and of the latter, those which are most beautiful (palms, tree ferns, plantains, arborescent grasses, and the finely-divided feathery foliage of the Mimosas)—remain for ever unknown to them. Individual plants languishing in our hot-houses can give but a very faint idea of the majestic vegetation of the tropical zone. But the high cultivation of our languages, the glowing fancy of the poet, and the imitative art of the painter, open to us sources whence flow abundant compensations, and from whence our imagination can derive the living image of that more vigorous nature which other climes display. In the frigid North, in the midst of the barren heath, the solitary student can appropriate mentally all that has been discovered in the most distant regions, and can create within himself a world free and imperishable as the spirit by which it is conceived.

SELECT EXTRACTS FROM THE POETS,

CHRONOLOGICALLY ARRANGED.

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SPENSER.

SPENSER was born in London in 1553, and died in 1599. His principal work is called "The Faerie Queen." His poems "exhibit at once exquisite sweetness and felicity of language, a luxuriant beauty of imagination which has hardly ever been surpassed, and a tenderness of feeling never elsewhere conjoined with an imagination so vivid."—*Spalding.*

UNA AND THE LION.

YET she, most faithful lady, all this while
  Forsaken, woful, solitary maid,
  Far from all people's crowd, as in exile,
  In wilderness and wasteful deserts stray'd
  To seek her knight ; who, subtlely betray'd
  Through that late vision which the enchanter wrought,
  Had her abandoned : she, of nought afraid,
  Through woods and wastenes[1] wide him daily sought,
Yet wished tidings none of him unto her brought.

One day, nigh weary of the irksome way,
  From her unhasty beast she did alight ;
  And on the grass her dainty limbs did lay
  In secret shadow, far from all men's sight ;
  From her fair head her fillet she undight,
  And laid her stole aside : her angel's face,
  As the great eye of heaven shined bright,
  And made a sunshine in the shady place :
Did never mortal eye behold such heavenly grace.

[1] Wastes.

It fortuned out of the thicket wood
  A ramping lion rushed suddenly,
  Hunting full greedy after savage blood;
  Soon as the royal virgin he did spy,
  With gaping mouth at her ran greedily,
  To have at once devoured her tender corse:
  But to the prey when as he drew more nigh,
  His bloody rage assuaged with remorse,
And with the sight amazed, forgot his furious force.

Instead thereof he kiss'd her weary feet,
  And lick'd her lily hands with fawning tongue;
  As he her wronged innocence did meet.
  Oh! how can beauty master the most strong,
  And simple truth subdue avenging wrong!
  Whose yielded pride and proud submission,
  Still dreading death, when she had marked long,
  Her heart did melt in great compassion;
And drizzling tears did shed for pure affection.

. . . .

Redounding tears did choke the end of her plaint,
  Which softly echoed from the neighbour wood;
  And, sad to see her sorrowful constraint,
  The kingly beast upon her gazing stood:
  With pity calm'd, down fell his angry mood.
  At last, in close heart shutting up her pain,
  Arose the virgin born of heavenly brood,
  And to her snowy palfrey got again,
To seek her strayed champion if she might attain.

The lion would not leave her desolate,
  But with her went along, as a strong guard
  Of her chaste person, and a faithful mate
  Of her sad troubles and misfortunes hard:
  Still when she slept, he kept both watch and ward;
  And when she waked, he waited diligent,
  With humble service to her will prepared:
  From her fair eyes he took commandment,
And ever by her looks conceived her intent.

Angels watching over Mankind.

And is there care in heaven, and is there love
  In heavenly spirits to these creatures base
That may compassion of their evils move?
  There is—else much more wretched were the case
Of men than beasts: But oh! the exceeding grace
  Of highest God that loves his creatures so,
And all his works with mercy doth embrace;
  That blessed angels he sends to and fro,
To serve to wicked man, to serve his wicked foe!

How oft do they their silver bowers leave,
  To come to succour us that succour want!
How oft do they with golden pinions cleave
  The flitting skies like flying pursuivant,
Against foul fiends to aid us militant!
  They for us fight; they watch and duly ward,
And their bright squadrons round about us plant;
  And all for love and nothing for reward:
Oh why should heavenly God to men have such regard!

The Seasons.

So forth issued the Seasons of the year:
First, lusty Spring, all dight in leaves of flowers
That freshly budded, and new blooms did bear,
In which a thousand birds had built their bowers,
That sweetly sung to call forth paramours;
And in his hand a javelin he did bear,
And on his head (as fit for warlike stoures)
A gilt engraven morion he did wear;
That as some did him love, so others did him fear.

Then came the jolly Summer, being dight
In a thin silken cassock coloured green,
That was unlined all, to be more light:
And on his head a garland well beseen
He wore, from which as he had chauffed[1] been,
The sweat did drop; and in his hand he bore

[1] Angered.

A bow and shafts, as he in forest green
Had hunted late the libbard[1] or the boar,
And now would bathe his limbs with labour heated sore.

Then came the Autumn, all in yellow clad,
As though he joyed in his plenteous store,
Laden with fruits that made him laugh full glad
That he had banished hunger, which to-fore
Had by the belly oft him pinched sore.
Upon his head a wreath, that was enrolled
With ears of corn of every sort, he bore;
And in his hand a sickle he did hold,
To reap the ripened fruits the which the earth had yold.

Lastly came Winter, clothed all in frize,
Chattering his teeth for cold that did him chill;
Whilst on his hoary beard his breath did freeze,
And the dull drops, that from his purpled bill
As from a limbeck, did adown distil.
In his right hand a tipped staff he held,
With which his feeble steps he stayed still;
For he was faint with cold, and weak with eld,
That scarce his loosed limbs he able was to weld.

SHAKSPERE.

SHAKSPERE was born at Stratford-upon-Avon in 1564, and died in 1616. He wrote numerous dramas, both tragic and comic. His sonnets also are among the finest compositions in our language. In the words of Hallam we may say, " The name of Shakspere is the greatest in our literature—it is the greatest in all literature. No man ever came near him in the creative powers of the mind; no man ever had such strength at once and such variety of imagination."

COMBAT OF HOTSPUR AND HENRY PRINCE OF WALES.
("*King Henry IV.*," *Part* 1, *Act* 5.)

Enter HOTSPUR.

Hot. IF I mistake not, thou art Harry Monmouth.
Pr. Hen. Thou speak'st as if I would deny my name.
Hot. My name is Harry Percy.

[1] Leopard.

Pr. Hen. Why then, I see
A very valiant rebel of the name.
I am the Prince of Wales, and think not, Percy,
To share with me in glory any more.
Two stars keep not their motion in one sphere;
Nor can one England brook a double reign,
Of Harry Percy and the Prince of Wales.
Hot. Nor shall it, Harry, for the hour is come
To end the one of us. And would to God
Thy name in arms were now as great as mine!
Pr. Hen. I'll make it greater ere I part from thee;
And all the budding honours on thy crest
I'll crop to make a garland for my head.
Hot. I can no longer brook thy vanities.
. . . . [*They figh*

HOTSPUR *is wounded and falls.*

Hot. O Harry! thou hast robb'd me of my youth:
I better brook the loss of brittle life,
Than those proud titles thou hast won of me.
They wound my thoughts worse than thy sword my flesh:
But thought's the slave of life, and life time's fool;
And time, that takes survey of all the world,
Must have a stop. Oh! I could prophesy,
But that the earthy and cold hand of death
Lies on my tongue. No, Percy, thou art dust,
And food for— [*Dies.*
Pr. Hen. For worms, brave Percy: Fare thee well, great heart!
Ill-weaved ambition, how much art thou shrunk!
When that this body did contain a spirit,
A kingdom for it was too small a bound;
But now, two paces of the vilest earth
Is room enough. This earth, that bears thee dead,
Bears not alive so stout a gentleman.
If thou wert sensible of courtesy,
I should not make so dear a show of zeal:
But let my favours hide thy mangled face!
And, even in thy behalf, I'll thank myself
For doing these fair rites of tenderness.
Adieu, and take thy praise with thee to heaven!
Thy ignominy sleep with thee in the grave,
But not remembered in thy epitaph!

Music.—("*Merchant of Venice*," *Act* 5.)

Lor. How sweet the moonlight sleeps upon this bank!
Here will we sit, and let the sounds of music
Creep in our ears; soft stillness, and the night
Become the touches of sweet harmony.
Sit, Jessica: look how the floor of heaven
Is thick inlaid with patines[1] of bright gold.
There's not the smallest orb, which thou behold'st,
But in his motion like an angel sings,
Still choiring to the young-eyed cherubims:
Such harmony is in immortal souls!
But whilst this muddy vesture of decay
Doth grossly close it in, we cannot hear it.
[*Enter Musicians.*
Come, ho, and wake Diana with a hymn;
With sweetest touches pierce your mistress' ear,
And draw her home with music. [*Music.*
Jes. I'm never merry, when I hear sweet music.
Lor. The reason is, your spirits are attentive:
For do but note a wild and wanton herd,
Or race of youthful and unhandled colts,
Fetching mad bounds, bellowing and neighing loud,
Which is the hot condition of their blood,
If they but hear perchance a trumpet sound,
Or any air of music touch their ears,
You shall perceive them make a mutual stand;
Their savage eyes turned to a modest gaze,
By the sweet power of music. Therefore the poet
Did feign that Orpheus drew trees, stones, and floods;
Since nought so stockish, hard, and full of rage,
But music for the time doth change his nature.
The man that hath no music in himself,
Nor is not moved with concord of sweet sounds,
Is fit for treasons, stratagems, and spoils;
The motions of his spirit are dull as night,
And his affections dark as Erebus:
Let no such man be trusted—Mark the music.

[1] A *patine* is a small flat plate.

Enter PORTIA *and* NERISSA *at a distance.*

Por. That light we see is burning in my hall :—
How far that little candle throws his beams !
So shines a good deed in a naughty world.
Ner. When the moon shone, we did not see the candle.
Por. So doth the greater glory dim the less :
A substitute shines brightly as a king,
Until a king be by ; and then his state
Empties itself, as doth an inland brook
Into the main of waters.—Music, hark ! [*Music*
Ner. It is your music, madam, of the house.
Por. Nothing is good, I see, without respect :
Methinks it sounds much sweeter than by day.
Ner. Silence bestows that virtue on it, madam.
Por. The crow doth sing as sweetly as the lark,
When neither is attended ; and, I think,
The nightingale, if she should sing by day,
When every goose is cackling, would be thought
No better a musician than the wren.
How many things by season seasoned are
To their right praise, and true perfection !

MARK ANTONY'S ORATION OVER THE BODY OF CÆSAR.
("*Julius Cæsar,*" *Act* 3.)

1 *Cit.* THIS Cæsar was a tyrant.
3 *Cit.* Nay, that's certain :
We are blest that Rome is rid of him.
2 *Cit.* Peace ! let us hear what Antony can say.
Ant. You gentle Romans,—
All. Peace, ho ! let us hear him.
Ant. Friends, Romans, countrymen, lend me your ears !
I come to bury Cæsar, not to praise him.
The evil that men do lives after them ;
The good is oft interred with their bones :
So let it be with Cæsar ! The noble Brutus
Hath told you Cæsar was ambitious :
If it were so, it was a grievous fault,
And grievously hath Cæsar answered it.
Here, under leave of Brutus, and the rest,—

For Brutus is an honourable man,
So are they all, all honourable men,—
Come I to speak in Cæsar's funeral.
He was my friend, faithful and just to me;
But Brutus says he was ambitious;
And Brutus is an honourable man.
He hath brought many captives home to Rome,
Whose ransoms did the general coffers fill;
Did this in Cæsar seem ambitious?
When that the poor have cried, Cæsar hath wept;
Ambition should be made of sterner stuff:
Yet Brutus says he was ambitious;
And Brutus is an honourable man.
You all did see that, on the Lupercal,[1]
I thrice presented him a kingly crown,
Which he did thrice refuse. Was this ambition?
Yet Brutus says he was ambitious;
And sure he is an honourable man.
I speak not to disprove what Brutus spoke,
But here I am to speak what I do know.
You all did love him once, not without cause;
What cause withholds you then to mourn for him?
O judgment! thou art fled to brutish beasts,
And men have lost their reason. Bear with me,
My heart is in the coffin there with Cæsar,
And I must pause till it come back to me.
1 *Cit.* Methinks there is much reason in his sayings. . . .
2 *Cit.* If thou consider rightly of the matter,
Cæsar has had great wrong. . . .
Ant. But yesterday the word of Cæsar might
Have stood against the world: now lies he there,
And none so poor to do him reverence.
O masters! if I were disposed to stir
Your hearts and minds to mutiny and rage,
I should do Brutus wrong, and Cassius wrong,
Who, you all know, are honourable men.
I will not do them wrong: I rather choose
To wrong the dead, to wrong myself and you,
Than I will wrong such honourable men.

[1] The feast of the god Pan.

But here's a parchment, with the seal of Cæsar,—
I found it in his closet,—'tis his will;
Let but the commons hear this testament,
Which, pardon me, I do not mean to read,
And they would go and kiss dead Cæsar's wounds,
And dip their napkins in his sacred blood;
Yea, beg a hair of him for memory,
And dying, mention it within their wills,
Bequeathing it as a rich legacy
Unto their issue.

. . . .

Cit. The will, the will! we will hear Cæsar's will. . .
Ant. Will you be patient? Will you stay awhile?
I have o'ershot myself, to tell you of it.
I fear I wrong the honourable men
Whose daggers have stabb'd Cæsar: I do fear it. . .
Cits. They were villains, murderers! The will!
Read the will! . . .
Ant. If you have tears, prepare to shed them now.
You all do know this mantle: I remember
The first time ever Cæsar put it on;
'Twas on a summer's evening in his tent,
That day he overcame the Nervii.
Look! in this place ran Cassius' dagger through;
See what a rent the envious Casca made;
Through this the well-beloved Brutus stabb'd;
And, as he pluck'd his cursed steel away,
Mark how the blood of Cæsar follow'd it!—
As rushing out of doors, to be resolved
If Brutus so unkindly knock'd, or no.
For Brutus, as you know, was Cæsar's angel:
Judge, oh you gods! how dearly Cæsar loved him!
This was the most unkindest cut of all;
For when the noble Cæsar saw him stab,
Ingratitude, more strong than traitors' arms,
Quite vanquish'd him; then burst his mighty heart:
And, in his mantle muffling up his face,
Even at the base of Pompey's statue,
Which all the while ran blood, great Cæsar fell
Oh, what a fall was there, my countrymen!

Then I, and you, and all of us fell down;
Whilst bloody treason flourish'd over us.
Oh, now you weep! and, I perceive you feel
The dint of pity, these are gracious drops.
Kind souls! what, weep you when you but behold
Our Cæsar's vesture wounded? look you here!
Here is himself, marr'd, as you see, by traitors.

1 *Cit.* O piteous spectacle!

2 *Cit.* O noble Cæsar!

3 *Cit.* O woful day!

4 *Cit.* O trait'rous villains! . . . .

2 *Cit.* We will be revenged! . . .

Ant. Good friends, sweet friends, let me not stir you up
To such a sudden flood of mutiny:
They that have done this deed are honourable.
What private griefs[1] they have, alas! I know not,
That made them do it;—they are wise and honourable,
And will, no doubt, with reasons answer you.
I come not, friends, to steal away your hearts;
I am no orator, as Brutus is,
But, as you know me all, a plain blunt man,
That love my friend; and that they know full well
That give me public leave to speak of him;
For I have neither wit, nor words, nor worth,
Action nor utt'rance, nor the power of speech
To stir men's blood; I only speak right on.
I tell you that which you yourselves do know;
Show you sweet Cæsar's wounds,—poor, poor dumb mouths
And bid them speak for me. But were I Brutus,
And Brutus Antony, there were an Antony
Would ruffle up your spirits, and put a tongue
In every wound of Cæsar, that should move
The stones of Rome to rise and mutiny.

All. We'll mutiny!

1 *Cit.* We'll burn the house of Brutus!

3 *Cit.* Away then, come, seek the conspirators.

[1] Grievances; causes of resentment.

Fall of Wolsey.—("*Henry VIII.*," *Act* 3.)

Wol. Farewell, a long farewell to all my greatness!
This is the state of man: to-day he puts forth
The tender leaves of hope; to-morrow blossoms,
And bears his blushing honours thick upon him;
The third day comes a frost, a killing frost,
And when he thinks, good easy man, full surely
His greatness is a rip'ning, nips his shoot;
And then he falls, as I do. I have ventured,
Like little wanton boys, that swim on bladders,
This many summers in a sea of glory;
But far beyond my depth: my high-blown pride
At length broke under me; and now has left me,
Weary and old with service, to the mercy
Of a rude stream, that must for ever hide me.
Vain pomp and glory of this world, I hate ye!
I feel my heart new-open'd. Oh, how wretched
Is that poor man that hangs on princes' favours!
There is, betwixt that smile he would aspire to,
That sweet aspect of princes, and his ruin,
More pangs and fears than wars or women have;
And when he falls, he falls like Lucifer,
Never to hope again. [*Enter Cromwell.*
Why, how now, Cromwell?
Crom. I have no power to speak, sir.
Wol. What, amazed
At my misfortunes? Can thy spirit wonder
A great man should decline? Nay, an you weep,
I am fallen indeed.
Crom. How does your Grace?
Wol. Why, well;
Never so truly happy, my good Cromwell.
I know myself now, and I feel within me
A peace above all earthly dignities;
A still and quiet conscience. The King has cured me,
I humbly thank his Grace; and, from these shoulders,
These ruin'd pillars, out of pity taken
A load would sink a navy, too much honour.

Oh, 'tis a burden, Cromwell, 'tis a burden
Too heavy for a man that hopes for heaven!

. . . .

Go get thee from me, Cromwell;
I am a poor fallen man, unworthy now
To be thy lord and master. Seek the King.
(That sun I pray may never set,) I've told him
What, and how true thou art; he will advance thee,
Some little memory of me will stir him
(I know his noble nature) not to let
Thy hopeful service perish too. Good Cromwell,
Neglect him not; make use now and provide
For thine own future safety.
Crom. O my Lord!
Must I then leave you? Must I needs forego
So good, so noble, and so true a master?
Bear witness all that have not hearts of iron,
With what a sorrow Cromwell leaves his lord.
The King shall have my service, but my prayers
For ever, and for ever, shall be yours.
Wol. Cromwell, I did not think to shed a tear
In all my miseries, but thou hast forced me,
Out of thy honest truth, to play the woman—
Let's dry our eyes; and thus far hear me, Cromwell,
And when I am forgotten, as I shall be,
And sleep in dull cold marble, where no mention
Of me must more be heard, say then I taught thee;
Say Wolsey, that once rode the waves of glory,
And sounded all the depths and shoals of honour,
Found thee a way, out of his wreck, to rise in;
A sure and safe one, though thy master missed it.
Mark but my fall, and that that ruined me.
Cromwell, I charge thee fling away ambition;
By that sin fell the angels; how can man then
(Though th' image of his Maker) hope to win by 't?
Love thyself last; cherish those hearts that hate thee;
Corruption wins not more than honesty.
Still in thy right hand carry gentle peace,
To silence envious tongues. Be just, and fear not.
Let all the ends thou aim'st at be at thy country's,

Than in the perfumed chambers of the great,
Under the canopies of costly state,
And lull'd with sounds of sweetest melody ?
O thou dull god ! why liest thou with the vile
In loathsome beds, and leav'st the kingly couch
A watch-case for a common larum bell ?
Wilt thou, upon the high and giddy mast,
Seal up the ship-boy's eyes, and rock his brains
In cradle of the rude imperious surge ;
And, in the visitation of the winds,
Who take the ruffian billows by the top,
Curling their monstrous heads, and hanging them
With deafening clamours in the slippery shrouds,
That, with the hurly, Death itself awakes—
Canst thou, O partial Sleep ! give thy repose
To the wet sea-boy in an hour so rude,
And, in the calmest and most stillest night,
With all appliances and means to boot,
Deny it to a king ? Then, happy, low lie down !
Uneasy lies the head that wears a crown.

Morning.

Full many a glorious morning have I seen
Flatter the mountain-tops with sovereign eye,
Kissing with golden face the meadows green,
Gilding pale streams with heavenly alchemy,
Anon permit the basest clouds to ride
With ugly rack on his celestial face,
And from the forlorn world his visage hide,
Stealing unseen to west with this disgrace.

Proper Use of Talents.—("*Measure for Measure*," *Act* 1.)

Heaven doth with us, as we with torches do,
Not light them for themselves : for if our virtues
And liquid lapse of murmuring streams ; by these,
Creatures that lived and moved, and walked or flew ;
Birds on the branches warbling. All things smiled ;

The smallest scruple of her excellence,
But, like a thrifty goddess, she determines
Herself the glory of a creditor,
Both thanks and use.

GOOD CONSCIENCE.—(*From "Henry VI.," Part 2, Act* 6.)

WHAT stronger breastplate than a heart untainted?
Thrice is he arm'd that hath his quarrel just;
And he but naked, though lock'd up in steel,
Whose conscience with injustice is corrupted.

THE VOICE OF THE DYING.—("*Richard II.," Act* 2.)

THE tongues of dying men
Enforce attention, like deep harmony.
Where words are scarce, they're seldom spent in vain:
For they breathe truth that breathe their words in pain.
He that no more must say, is listen'd more
Than they whom youth and ease have taught to glose;
More are men's ends mark'd, than their lives before:
The setting sun, and music at the close,
As the last taste of sweets is sweetest last;
Writ in remembrance, more than things long past.

MILTON.

MILTON was born in London in 1608, and died in 1674. During a great part of his life he was engaged in discharging the active duties of a political secretary. His youthful poems, such as *L'Allegro, Il Penseroso,* and the *Comus,* exhibit varied fancy and great tenderness of feeling. But his greatest work is the *Paradise Lost,* written after his retirement from public life, and which is unequalled for the grandeur and dignity of its conception, and the majesty of its language. During the latter portion of his life he was afflicted with blindness.

Still in thy right hand carry gentle peace,
To silence envious tongues. Be just, and fear not.
Let all the ends thou aim'st at be at thy country's,

Eve to Adam.—(B. 4.)

With thee conversing I forget all time;
All seasons, and their change, all please alike.
Sweet is the breath of Morn, her rising sweet,
With charm of earliest birds; pleasant the Sun,
When first on this delightful land he spreads
His orient beams on herb, tree, fruit, and flower,
Glistering with dew: fragrant the fertile Earth
After soft showers; and sweet the coming on
Of grateful Evening mild; then silent Night,
With this her solemn bird, and this fair Moon,
And these the gems of Heaven, her starry train.
But neither breath of Morn, when she ascends
With charm of earliest birds; nor rising Sun
On this delightful land; nor herb, fruit, flower,
Glistering with dew; nor fragrance after showers;
Nor grateful Evening mild; nor silent Night,
With this her solemn bird; nor walk by Moon
Or glittering star-light, without thee, is sweet.

Christ in the Wilderness. A Storm.
("*Paradise Regained*," B. 4.)

So saying, he took (for still he knew his power

Adam's first Sensations after his Creation.—(B. 8.)

As new waked from soundest sleep,
Soft on the flowery herb I found me laid,
In balmy sweat which with his beams the Sun
Soon dried, and on the reeking moisture fed.
Straight toward heaven my wondering eyes I turned,
And gazed a while the ample sky; till, raised
By quick instinctive motion, up I sprung,
As thitherward endeavouring, and upright
Stood on my feet. About me round I saw
Hill, dale, and shady woods, and sunny plains,
And liquid lapse of murmuring streams; by these,
Creatures that lived and moved, and walked or flew;
Birds on the branches warbling. All things smiled;

From many a horrid rift, abortive poured
Fierce rain with lightning mixed, water with fire
In ruin reconciled : nor slept the winds
Within their stony caves, but rushed abroad
From the four hinges of the world, and fell
On the vexed wilderness, whose tallest pines,
Though rooted deep as high, and sturdiest oaks,
Bowed their stiff necks, loaden with stormy blasts,
Or torn up sheer. Ill wast thou shrouded then,
O patient Son of God, yet only stoodst
Unshaken ! Nor yet stay'd the terror there ;
Infernal ghosts and hellish furies round
Environed thee ; some howled, some yelled, some shrieked ;
Some bent at thee their fiery darts, while thou
Satst unappalled in calm and sinless peace !
Thus passed the night so foul, till morning fair
Came forth, with pilgrim steps, in amice grey;
Who with her radiant finger stilled the roar
Of thunder, chased the clouds, and laid the winds,
And grisly spectres, which the fiend had raised
To tempt the Son of God with terrors dire.
And now the sun with more effectual beams
Had cheered the face of earth, and dried the wet
From drooping plant, or dropping tree : the birds,
Who all things now behold more fresh and green,
After a night of storm so ruinous,
Cleared up their choicest notes in bush and spray,
To gratulate the sweet return of morn.

POPE.

Pope was born in London in 1688, and died in 1744. In him what has been sometimes called the French School of Poetry culminated. The characteristic of this school is, that it is more distinguished by precision and elegance of diction, and smooth melody of versification, than by originality of thought, strength of imagination, or freshness of feeling. In Pope, however, in whom all the excellences of this school met, we find vigorous thought, and shrewd observation of life and character. Some of his poems exhibit a refined fancy and delicacy of feeling, which almost lead the reader to think that he would have been a greater poet had he not subjected his imagination to a limited theory of the poetic art. The most distinguished poet between Milton and Pope was Dryden.

BLESSING OF A CONCEALED FUTURE.—("*Essay on Man.*")

HEAVEN from all creatures hides the book of Fate,
All but the page prescribed, their present state:
From brutes what men, from men what spirits know:
Or who could suffer being here below?
The lamb thy riot dooms to bleed to-day,
Had he thy reason, would he skip and play?
Pleased to the last, he crops the flowery food,
And licks the hand just raised to shed his blood.
Oh, blindness to the future! kindly given,
That each may fill the circle mark'd by Heaven:
Who sees with equal eye, as God of all,
A hero perish, or a sparrow fall,
Atoms or systems into ruin hurl'd,
And now a bubble burst, and now a world.
Hope humbly, then; with trembling pinions soar,
Wait the great teacher, Death; and God adore.
What future bliss, he gives not thee to know,
But gives that hope to be thy blessing now.
Hope springs eternal in the human breast:
Man never Is, but always To be blest:
The soul, uneasy, and confined from home,
Rests and expatiates in a life to come.[1]

THOMSON.

THOMSON was born at Ednam, Roxburghshire, in 1700, and died in 1748. His chief works are *The Seasons*, and *The Castle of Indolence*, in which we find genuine poetic feeling and an intense love of external nature.

THE PATRIOT'S PRAYER FOR ENGLAND

ISLAND of bliss! amid the subject seas
That thunder round thy rocky coasts set up,
At once the wonder, terror, and delight
Of distant nations, whose remotest shore
Can soon be shaken by thy naval arms;

[1] Pope's poetry generally can be enjoyed only by matured intellects. The compiler has therefore confined himself to a single extract as a specimen of the poet's style.

Not to be shook thyself, but all assaults
Baffling, like thy hoar cliffs the loud sea wave.
O Thou, by whose almighty nod the scale
Of empire rises, or alternate falls,
Send forth the saving virtues round the land,
In bright patrol: white peace and social love,
The tender-looking charity, intent
On gentle deeds, and shedding tears through smiles;
Undaunted truth, and dignity of mind;
Courage composed, and keen; sound temperance,
Healthful in heart and look; clear chastity,
With blushes reddening as she moves along,
Disordered at the deep regard she draws;
Rough industry; activity untired
With copious life informed, and all awake;
While in the radiant front, superior shines
That first paternal virtue, public zeal—
Who throws o'er all an equal wide survey,
And, ever musing on the common weal,
Still labours glorious with some great design.

Approach of Spring, and the Labours of the Field in that Season, described.

Come, gentle Spring, ethereal mildness, come,
And from the bosom of yon dropping cloud,
While music wakes around, veil'd in a shower
Of shadowing roses, on our plains descend!

. . . . .

And see where surly Winter passes off,
Far to the north, and calls his ruffian blasts:
His blasts obey, and quit the howling hill,
The shatter'd forest, and the ravaged vale;
While softer gales succeed, at whose kind touch,
Dissolving snows in livid torrents lost,
The mountains lift their green heads to the sky.
As yet the trembling year is unconfirm'd,
And winter oft at eve resumes the breeze,
Chills the pale morn, and bids his driving sleets
Deform the day delightless: so that scarce
The bittern knows his time, with bill engulf'd.

To shake the sounding marsh ; or, from the shore,
The plovers, when to scatter o'er the heath
And sing their wild notes to the listening waste.
At last from *Aries* rolls the bounteous Sun,
And the bright *Bull* receives him. Then no more
The expansive atmosphere is cramp'd with cold ;
But, full of life and vivifying soul,
Lifts the light clouds sublime, and spreads them thin,
Fleecy, and white, o'er all-surrounding heaven.
Forth fly the tepid airs ; and, unconfined,
Unbinding earth, the moving softness strays.
Joyous, the impatient husbandman perceives
Relenting Nature, and his lusty steers
Drives from their stalls, to where the well-used plough
Lies in the furrow, loosen'd from the frost.
There, unrefusing, to the harness'd yoke
They lend their shoulder, and begin their toil,
Cheer'd by the simple song, and soaring lark.
Meanwhile, incumbent, o'er the shining share,
The master leans, removes the obstructing clay,
Winds the whole work, and sidelong lays the glebe.
White, through the neighbouring fields, the sower stalks,
With measured step ; and liberal throws the grain
Into the faithful bosom of the ground ;
The harrow follows harsh, and shuts the scene.
Be gracious, Heaven ! for now laborious man
Has done his part. Ye fostering breezes, blow !
Ye softening dews, ye tender showers, descend !
And temper all, thou world-reviving sun,
Into the perfect year ! Nor ye who live
In luxury and ease, in pomp and pride,
Think these lost themes unworthy of your ear :
Such themes as these the rural Maro sung
To wide imperial Rome in the full height
Of elegance and taste, by Greece refined.
In ancient times, the sacred plough employ'd
The kings and awful fathers of mankind :
And some, with whom compared your insect tribes
Are but the beings of a summer's day,
Have held the scale of empire, ruled the storm

Of mighty war; then, with unwearied hand,
Disdaining little delicacies, seized
The plough, and greatly independent lived.
Ye generous Britons, venerate the plough,
And o'er your hills, and long withdrawing vales,
Let Autumn spread his treasures to the sun,
Luxuriant and unbounded. As the Sea,
Far through his azure turbulent domain,
Your empire owns, and, from a thousand shores,
Wafts all the pomp of life into your ports;
So, with superior boon, may your rich soil,
Exuberant, Nature's better blessings pour
O'er every land, the naked nations clothe,
And be the exhaustless granary of a world!

Evening after a Shower in Spring.

Thus, all day long, the full distended clouds
Indulge their genial stores: and well-shower'd earth
Is deep enrich'd with vegetable life;
Till, in the western sky, the downward sun
Looks out, effulgent, from amid the flush
Of broken clouds, gay-shifting to his beam.
The rapid radiance instantaneous strikes
The illumined mountain, through the forest streams,
Shakes on the floods, and in a yellow mist,
Far smoking o'er the interminable plain,
In twinkling myriads lights the dewy gems.
Moist, bright and green, the landscape laughs around.
Full swell the woods; their very music wakes,
Mix'd in wild concert, with the warbling brooks
Increased, the distant bleatings of the hills,
And hollow lows responsive from the vales,
Whence, blending all, the sweeten'd zephyr springs.
Meantime, refracted from yon eastern cloud,
Bestriding earth, the grand ethereal bow
Shoots up immense; and every hue unfolds,
In fair proportion running from the red,
To where the violet fades into the sky.
Here, awful Newton! the dissolving clouds

Form, fronting on the sun, thy showery prism ;
And, to the sage instructed eye, unfold
The various twine of light, by thee disclosed
From the white mingling maze. Not so the boy :
He, wondering, views the bright enchantment bend
Delightful o'er the radiant fields, and runs
To catch the falling glory ; but, amazed,
Beholds the amusive arch before him fly,
Then vanish quite away. Still night succeeds,
A soften'd shade ; and saturated earth
Awaits the morning beam, to give to light,
Raised through ten thousand different plastic tubes,
The balmy treasures of the former day.

A Prayer.

Father of light and life ! thou Good Supreme !
O teach me what is good ! teach me Thyself !
Save me from folly, vanity, and vice,
From every low pursuit ! and feed my soul
With knowledge, conscious peace, and virtue pure ;
Sacred, substantial, never-fading bliss.

GRAY.

Gray was born in London in 1716, and died 1771. His poems are lyrical, and characterized by great aptness of language, elaborateness, and finish of construction. His natural feelings are too much restrained within the limits of his fastidious judgment. His principal odes are *The Elegy in a Country Churchyard, The Progress of Poesy,* and *The Ode on Eton College.*

Elegy written in a Country Churchyard.

The curfew tolls the knell of parting day,
The lowing herd wind slowly o'er the lea,
The ploughman homeward plods his weary way,
And leaves the world to darkness and to me.

Now fades the glimmering landscape on the sight,
And all the air a solemn stillness holds,
Save where the beetle wheels his droning flight,
And drowsy tinklings lull the distant folds :

Save that, from yonder ivy-mantled tower,
The moping owl does to the moon complain
Of such as, wandering near her secret bower,
Molest her ancient solitary reign.

Beneath those rugged elms, that yew-tree's shade,
Where heaves the turf in many a mouldering heap,
Each in his narrow cell for ever laid,
The rude forefathers of the hamlet sleep.

The breezy call of incense-breathing morn,
The swallow twittering from the straw-built shed,
The cock's shrill clarion, or the echoing horn,
No more shall rouse them from their lowly bed.

For them no more the blazing hearth shall burn,
Or busy housewife ply her evening care;
No children run to lisp their sire's return,
Or climb his knees the envied kiss to share.

Oft did the harvest to their sickle yield,
Their furrow oft the stubborn glebe has broke,
How jocund did they drive their team a-field!
How bow'd the woods beneath their sturdy stroke!

Let not ambition mock their useful toil,
Their homely joys and destiny obscure;
Nor grandeur hear with a disdainful smile,
The short and simple annals of the poor.

The boast of heraldry, the pomp of power,
And all that beauty, all that wealth e'er gave,
Await alike th' inevitable hour,
The paths of glory lead but to the grave.

Nor you, ye proud, impute to these the fault,
If memory o'er their tomb no trophies raise,
Where, through the long-drawn aisle and fretted vault,
The pealing anthem swells the note of praise.

Can storied urn, or animated bust,
Back to its mansion call the fleeting breath?
Can honour's voice provoke the silent dust,
Or flattery soothe the dull cold ear of Death?

Perhaps, in this neglected spot is laid
Some heart once pregnant with celestial fire;
Hands, that the rod of empire might have sway'd,
Or waked to ecstasy the living lyre.

But Knowledge to their eyes her ample page,
Rich with the spoils of time, did ne'er unroll;
Chill penury repress'd their noble rage,
And froze the genial current of the soul.

Full many a gem of purest ray serene
The dark unfathom'd caves of ocean bear;
Full many a flower is born to blush unseen,
And waste its sweetness on the desert air.

Some village Hampden, that with dauntless breast
The little tyrant of his fields withstood;
Some mute inglorious Milton here may rest;
Some Cromwell, guiltless of his country's blood.

Th' applause of listening senates to command,
The threats of pain and ruin to despise,
To scatter plenty o'er a smiling land,
And read their history in a nation's eyes,

Their lot forbade: nor circumscribed alone
Their growing virtues, but their crimes confined;
Forbade to wade through slaughter to a throne,
And shut the gates of mercy on mankind.

The struggling pangs of conscious truth to hide,
To quench the blushes of ingenuous shame,
Or heap the shrine of luxury and pride
With incense kindled at the Muse's flame.

Far from the madding crowd's ignoble strife,
Their sober wishes never learn'd to stray;
Along the cool sequester'd vale of life
They kept the noiseless tenour of their way.

Yet ev'n these bones from insult to protect,
Some frail memorial still erected nigh,
With uncouth rhymes and shapeless sculpture deck'd,
Implores the passing tribute of a sigh.

Their name, their years, spelt by th' unletter'd Muse,
The place of fame and elegy supply ;
And many a holy text around she strews,
That teach the rustic moralist to die.

For who, to dumb forgetfulness a prey,
This pleasing anxious being e'er resign'd,
Left the warm precincts of the cheerful day,
Nor cast one longing, lingering look behind ?

On some fond breast the parting soul relies,
Some pious drops the closing eye requires ;
E'en from the tomb the voice of nature cries,
E'en in our ashes live their wonted fires.

For thee, who, mindful of th' unhonour'd dead,
Dost in these lines their artless tale relate ;
If chance, by lonely contemplation led,
Some kindred spirit shall inquire thy fate,

Haply some hoary-headed swain may say,
" Oft have we seen him at the peep of dawn,
Brushing with hasty steps the dews away,
To meet the sun upon the upland lawn.

" There at the foot of yonder nodding beech,
That wreathes its old fantastic roots so high,
His listless length at noontide would he stretch,
And pore upon the brook that bubbles by.

" Hard by yon wood, now smiling as in scorn,
Muttering his wayward fancies he would rove,
Now drooping, woful wan, like one forlorn,
Or crazed with care, or cross'd in hopeless love.

" One morn I miss'd him on the custom'd hill,
Along the heath, and near his favourite tree ;
Another came ; nor yet beside the rill,
Nor up the lawn, nor at the wood was he :

" The next, with dirges due, in sad array,
Slow through the churchway path we saw him borne ;
Approach, and read (for thou canst read) the lay,
Graved on the stone, beneath yon aged thorn."

THE EPITAPH.

Here rests his head upon the lap of Earth,
A Youth, to fortune and to fame unknown,
Fair Science frown'd not on his humble birth,
And Melancholy mark'd him for her own.

Large was his bounty, and his soul sincere,
Heaven did a recompense as largely send;
He gave to Misery all he had—a tear;
He gain'd from Heav'n ('twas all he wish'd) a friend.

No farther seek his merits to disclose,
Or draw his frailties from their dread abode
(There they alike in trembling hope repose),
The bosom of his Father and his God.

GOLDSMITH.

Oliver Goldsmith was born in Ireland, at Pallas, county Longford, in 1728, and died in 1774. More celebrated as an essayist or novelist, he yet achieved in poetry a higher name than any of his cotemporaries. "*The Traveller* and *The Deserted Village*," says Professor Spalding, "cannot be forgotten until the English tongue shall have ceased to be understood. A pleasing poet, not a great one, Goldsmith was nevertheless greater than he or his friends knew."

Swiss Life.—("*The Traveller*.")

Turn we to survey
Where rougher climes a nobler race display,
Where the bleak Swiss their stormy mansions tread,
And force a churlish soil for scanty bread:
No product here the barren hills afford
But man and steel, the soldier and his sword:
No vernal blooms their torpid rocks array,
But winter ling'ring chills the lap of May:
No zephyr fondly sues the mountain's breast,
But meteors glare, and stormy glooms invest.
Yet still, e'en here, content can spread a charm,
Redress the clime, and all its rage disarm.
Though poor the peasant's hut, his feasts tho' small,
He sees his little lot the lot of all;

Sees no contiguous palace rear its head,
To shame the meanness of his humble shed;
No costly lord the sumptuous banquet deal,
To make him loathe his vegetable meal;
But calm, and bred in ignorance and toil,
Each wish contracting fits him to the soil.
Cheerful at morn he wakes from short repose,
Breathes the keen air, and carols as he goes;
With patient angle trolls the finny deep,
Or drives his vent'rous ploughshare to the steep;
Or seeks the den where snow-tracks mark the way,
And drags the struggling savage into day.
At night returning, ev'ry labour sped,
He sits him down the monarch of a shed;
Smiles by his cheerful fire, and round surveys
His children's looks, that brighten at the blaze;
While his loved partner, boastful of her hoard,
Displays her cleanly platter on the board:
And haply too some pilgrim thither led,
With many a tale repays the nightly bed.[1]

COWPER.

COWPER was born at Berkhampstead in 1731, and died in 1800. His poems, which are chiefly didactic in character, are the productions of an observant, thoughtful, and cultivated mind. There is a vigour of thought, and correctness and freshness of expression in his works, which, taken along with their high moral aim, have gained for them great and deserved popularity.

GOD VISIBLE IN ALL NATURE.—("*The Task*," B. 6.)

THERE lives and works
A soul in all things, and that soul is God.
The beauties of the wilderness are His,
That make so gay the solitary place,
Where no eye sees them; and the fairer forms
That cultivation glories in are His.
He sets the bright procession on its way,
And marshals all the order of the year;

[1] Extracts from other portions of Goldsmith's *Poetical Works* will be found in the other volumes of this series.

He marks the bounds which Winter may not pass,
And blunts his pointed fury; in its case,
Russet and rude, folds up the tender germ,
Uninjured, with inimitable art;
And, ere one flowery season fades and dies,
Designs the blooming wonders of the next.

. . . . .

The Lord of all, Himself through all diffused,
Sustains, and is the life of all that lives.
Nature is but a name for an effect,
Whose cause is God. . . . One Spirit—His
Who wore the platted thorns, with bleeding brows—
Rules universal nature. Not a flower
But shows some touch, in freckle, streak, or stain,
Of his unrivalled pencil. He inspires
Their balmy odours, and imparts their hues,
And bathes their eyes with nectar, and includes,
In grains as countless as the sea-side sands,
The forms with which he sprinkles all the earth.
Happy who walks with him! whom what he finds
Of flavour or of scent in fruit or flower,
Or what he views of beautiful or grand
In Nature, from the broad majestic oak
To the green blade that twinkles in the sun,
Prompts with remembrance of a present God.

The Martyrs.—(B. 5.)

Patriots have toil'd, and in their country's cause
Bled nobly; and their deeds, as they deserve,
Receive proud recompense. We give in charge
Their names to the sweet lyre. The historic muse,
Proud of the treasure, marches with it down
To latest times; and sculpture, in her turn,
Gives bond in stone, and ever-during brass
To guard them, and to immortalize her trust:
But fairer wreaths are due, though never paid,
To those who, posted at the shrine of Truth,
Have fallen in her defence. A patriot's blood
Well spent in such a strife, may earn indeed,
And for a time insure, to his loved land,

The sweets of liberty and equal laws;
But martyrs struggle for a brighter prize,
And win it with more pain. Their blood is shed
In confirmation of the noblest claim—
Our claim to feed upon immortal truth,
To walk with God, to be divinely free,
To soar, and to anticipate the skies.
Yet few remember them. They lived unknown
Till persecution dragg'd them into fame,
And chased them up to heaven. Their ashes flew—
No marble tells us whither. With their names
No bard embalms and sanctifies his song:
And history, so warm on meaner themes,
Is cold on this. She execrates indeed
The tyranny that doom'd them to the fire,
But gives the glorious sufferers little praise.

Rural Sounds.—("*The Task*," B. 1.)

Not rural sights alone, but rural sounds
Exhilarate the spirit, and restore
The tone of languid nature. Mighty winds,
That sweep the skirt of some far-spreading wood
Of ancient growth, make music not unlike
The dash of ocean on his winding shore,
And lull the spirit while they fill the mind; . . .
Nor less composure waits upon the roar
Of distant floods, or on the softer voice
Of neighbouring fountain, or of rills that slip
Through the cleft rock, and, chiming as they fall
Upon loose pebbles, lose themselves at length
In matted grass, that with a livelier green
Betrays the secret of their silent course.

Vanity of Earthly Possessions.—(B. 3.)

All flesh is grass, and all its glory fades
Like the fair flower dishevelled in the wind:
Riches have wings, and grandeur is a dream:
The man we celebrate must find a tomb,

And we, that worship him, ignoble graves.
Nothing is proof against the general curse
Of vanity, that seizes all below.
The only amaranthine[1] flower on earth
Is Virtue; the only lasting treasure, Truth.

Winter.—(B. 4.)

O Winter, ruler of the inverted year,
Thy scatter'd hair with sleet-like ashes filled,
Thy breath congealed upon thy lips, thy cheeks
Fringed with a beard made white with other snows
Than those of age, thy forehead wrapt in clouds,
A leafless branch thy sceptre, and thy throne
A sliding car, indebted to no wheels,
But urged by storms along its slippery way,—
I love thee, all unlovely as thou seem'st,
And dreaded as thou art!

Evening.—(B. 4.)

Come, Evening, once again, season of peace;
Return, sweet Evening, and continue long!
Methinks I see thee in the streaky west,
With matron-step slow-moving, while the Night
Treads on thy sweeping train; one hand employed
In letting fall the curtain of repose
On bird and beast, the other charged for man
With sweet oblivion of the cares of day.
Not sumptuously adorn'd, not needing aid,
Like homely-featured Night, of clustering gems;
A star or two, just twinkling on thy brow,
Suffices thee; save that the moon is thine,
Not less than hers, not worn indeed on high,
With ostentatious pageantry, but set
With modest grandeur in thy purple zone,
Resplendent less, but of an ampler round.

[1] Unfading.

SCOTT.

SIR WALTER SCOTT was born at Edinburgh in 1771, and died at Abbotsford in 1832. His poems are chivalric romances in verse. Discarding sentiment, he deals only with action, following the model of the old ballads and romances. By this resuscitation of the old, he, in fact, introduced a new and fresh element into modern literature, and for this service well merited the popularity which he so largely enjoyed. His narratives are very spirited, and his style easy. Extracts from his *Poetical Works* will be found in the earlier volumes of this Series.

BURNS.

BURNS was born near Ayr in 1759, and died in 1796. He is the most popular of Scotch poets, and is distinguished for his humour and pathos.

ON HEARING A THRUSH SING IN A MORNING WALK IN JANUARY.

SING on, sweet thrush, upon the leafless bough,
Sing on, sweet bird, I listen to thy strain :
See aged winter, 'mid his surly reign,
At thy blythe carol clears his furrow'd brow.

So in lone Poverty's dominion drear,
Sits meek Content with light unanxious heart,
Welcomes the rapid movements, bids them part,
Nor asks if they bring aught to hope or fear.

I thank thee, Author of this opening day !
Thou whose bright sun now gilds the orient skies ;
Riches denied, thy boon was purer joys
What wealth could never give nor take away !

Yet come, thou child of poverty and care ;
The mite high Heaven bestow'd, that mite with thee I'll share.

TO A MOUNTAIN DAISY WHICH HE TURNED DOWN WITH HIS PLOUGH ON A COLD APRIL MORNING.

WEE, modest, crimson-tipped flow'r,
Thou'st met me in an evil hour,
For I maun crush amang the stoure[1]
Thy slender stem ;
To spare thee now is past my power,
Thou bonnie gem.

[1] Dust.

Alas! it's no thy neebor sweet,
The bonnie lark, companion meet!
Bending thee 'mang the dewy weet,
Wi' speckled breast,
When upward springing, blythe, to greet
The purpling east.

Cauld blew the bitter-biting north
Upon thy early, humble birth;
Yet cheerfully thou glinted forth
Amid the storm,
Scarce rear'd above the parent earth
Thy tender form.

The flaunting flow'rs our gardens yield
High shelt'ring woods and wa's maun shield;
But thou, beneath the random bield[1]
O' clod or stane,
Adorns the histie[2] stibble-fields,
Unseen, alane.

There in thy scanty mantle clad,
Thy snawy bosom sunward spread,
Thou lifts thy unassuming head
In humble guise;
But now the share uptears thy bed,
And low thou lies!

Such is the fate of artless maid,
Sweet flow'ret of the rural shade!
By love's simplicity betray'd,
And guileless trust,
Till she, like thee, all soiled, is laid
Low i' the dust.

Such is the fate of simple bard,
On life's rough ocean luckless starr'd!
Unskilful he to note the card
Of prudent lore,
Till billows rage, and gales blow hard,
And whelm him o'er!

Such fate to suffering worth is given,
Who long with wants and woes has striv'n,

[1] Shelter. [2] Dry.

By human pride or cunning driv'n
To misery's brink,
Till wrenched of every stay but Heav'n,
He, ruin'd, sink!

Even thou who mourn'st the daisy's fate,
That fate is thine—no distant date;
Stern Ruin's ploughshare drives, elate,
Full on thy bloom;
Till crush'd beneath the furrow's weight,
Shall be thy doom!

A BARD'S EPITAPH.

. . . .

Is there a man, whose judgment clear,
Can others teach the course to steer,
Yet runs, himself, life's mad career,
Wild as the wave?
Here, pause, and thro' the starting tear,
Survey this grave.

The poor inhabitant below
Was quick to learn, and wise to know,
And keenly felt the friendly glow,
And softer flame,
But thoughtless follies laid him low,
And stain'd his name!

Reader, attend—whether thy soul
Soars fancy's flights beyond the pole,
Or darkling grubs this earthly hole
In low pursuit;
Know, prudent, cautious self-control
Is wisdom's root.

WORDSWORTH.

WORDSWORTH was born in 1770, and died in 1850. He is now one of the greatest of English poets. His writings are pre-eminently sentimental and reflective in their character, and breathe a spirit of moral purity and religious fervour. His poems are lyrical, descriptive, and didactic.

To a Butterfly.

Stay near me! do not take thy flight!
A little longer stay in sight!
Much converse do I find in thee,
Historian of my infancy!
Float near me! do not yet depart!
  Dead times revive in thee;
Thou bring'st, gay creature as thou art,
A solemn image to my heart,
  My father's family!

Oh, pleasant, pleasant were the days,
The time when, in our childish plays,
My sister Emmeline and I
Together chased the butterfly.
A very hunter did I rush
  Upon the prey; with leaps and springs
I followed on from brake to bush;
But she (God love her!) fear'd to brush
  The dust from off its wings.

To a Skylark.

I.

Ethereal minstrel! pilgrim of the sky!
  Dost thou despise the earth where cares abound?
Or while the wings aspire, are heart and eye
  Both with thy nest upon the dewy ground?
Thy nest which thou canst drop into at will,
Those quivering wings composed, that music still!

II.

To the last point of vision, and beyond,
  Mount, daring warbler!—that love-prompted strain
('Twixt thee and thine a never-failing bond)
  Thrills not the less the bosom of the plain:
Yet mightst thou seem, proud privilege, to sing
All independent of the leafy spring.

III.

Leave to the nightingale her shady wood;
  A privacy of glorious light is thine;

Whence thou dost pour upon the world a flood
  Of harmony, with instinct more divine.
Type of the wise who soar, but never roam;
True to the kindred points of heaven and home!

The Labourer's Noon-day Hymn.

Up to the throne of God is borne
The voice of praise at early morn;
And he accepts the punctual hymn,
Sung as the light of day grows dim.

Nor will he turn his ear aside
From holy offerings at noon-tide;
Then, here reposing, let us raise
A song of gratitude and praise.

What though our burden be not light,
We need not toil from morn to night;
The respite of the mid-day hour
Is in the thankful creature's power.

Blest are the moments, doubly blest,
That, drawn from this one hour of rest,
Are with a ready heart bestow'd
Upon the service of our God!

Each field is then a hallowed spot,
An altar is in each man's cot,
A church in every grove that spreads
Its living roof above our heads.

Look up to heaven! th' industrious sun
Already half his race hath run:
He cannot halt nor go astray,
But our immortal spirits may.

Lord! since his rising in the east,
If we have falter'd or transgress'd,
Guide from thy love's abundant source
What yet remains of this day's course.

Help with thy grace through life's short day,
Our upward and our downward way;
And glorify for us the west,
When we shall sink to final rest.

THE INVITATION

It is the first mild day of March,
Each minute sweeter than before,
The redbreast sings from the tall larch
That stands beside our door.

There is a blessing in the air,
Which seems a sense of joy to yield
To the bare trees and mountains bare,
And grass in the green field.

My sister ('tis a wish of mine)
Now that our morning meal is done,
Make haste, your morning task resign;
Come forth and feel the sun.

Edward will come with you, and pray
Put on with speed your woodland dress:
And bring no book, for this one day
We'll give to idleness.

No joyless forms shall regulate
Our living calendar;
We from to-day, my friend, will date
The opening of the year.

Love, now a universal birth,
From heart to heart is stealing,
From earth to man, from man to earth:
It is the hour of feeling.

One moment now may give us more
Than years of toiling reason:
Our minds shall drink at every pore
The spirit of the season.

Some silent laws our hearts will make,
Which they shall long obey:
We for the year to come may take
Our temper from to-day.

And from the blessed power that rolls
About, below, above,
We'll frame the measure of our souls;
They shall be tuned to love.

Then come, my sister! come, I pray,
  With speed put on your woodland dress;
And bring no book; for this one day
  We'll give to idleness.

Nature.

NATURE never did betray
The heart that loved her; 'tis her privilege,
Through all the years of this our life, to lead
From joy to joy; for she can so inform
The mind that is within us, so impress
With quietness and beauty, and so feed
With lofty thoughts, that neither evil tongues,
Rash judgments, nor the sneers of selfish men,
Nor greetings where no kindness is, nor all
The dreary intercourse of daily life
Shall e'er prevail against us or disturb
Our cheerful faith, that all which we behold
Is full of blessings. Therefore let the moon
Shine on thee in thy solitary walk;
And let the misty mountain winds be free
To blow against thee: and, in after years,
When these wild ecstasies shall be matured
Into a sober pleasure, when thy mind
Shall be a mansion for all lovely forms,
Thy memory be as a dwelling-place
For all sweet sounds and harmonies; oh! then,
If solitude, or fear, or pain, or grief,
Should be thy portion, with what healing thoughts
Of tender joy wilt thou remember me,
And these my exhortations!

Immortality.

OUR birth is but a sleep and a forgetting:
The soul that rises with us, our life's star,
  Hath had elsewhere its setting,
    And cometh from afar:

Not in entire forgetfulness,
And not in utter nakedness,
But trailing clouds of glory do we come
From God who is our home.
Heaven lies about us in our infancy!
Shades of the prison-house begin to close
Upon the growing boy,
But he beholds the light, and whence it flows,
He sees it in his joy.
The Youth, who daily further from the east
Must travel, still is Nature's priest,
And by the vision splendid
Is on his way attended.
At length the Man perceives it die away,
And fade into the light of common day.

. . . . .

Those first affections,
Those shadowy recollections,
Which, be they what they may,
Are yet the fountain light of all our day,
Are yet a master light of all our seeing;
Uphold us, cherish, and have power to make
Our noisy years seem moments in the being
Of the eternal silence: truths that wake
To perish never;
Which neither listlessness, nor mad endeavour,
Nor man, nor boy,
Nor all that is at enmity with joy,
Can utterly abolish or destroy!
Hence in a season of calm weather,
Though inland far we be,
Our souls have sight of that immortal sea
Which brought us hither,
Can in a moment travel thither,
And see the children sport upon the shore,
And hear the mighty waters rolling evermore.

Lucy.

Three years she grew, in sun, and shower.
Then Nature said, " A lovelier flower
On earth was never sown;
This child I to myself will take;
She shall be mine, and I will make
A Lady of my own.

" Myself will, to my darling, be
Both law and impulse: and with me
The girl, on rock and plain,
In earth and heaven, in glade and bower,
Shall feel an overseeing power,
To kindle or restrain.

" She shall be sportive as the fawn,
That, wild with glee, across the lawn,
Or up the mountain springs;
And hers shall be the breathing balm,
And hers the silence, and the calm
Of mute insensate things.

" The floating clouds their state shall lend
To her; for her the willow bend;
Nor shall she fail to see,
Even in the motions of the storm,
Grace that shall mould the maiden's form
By silent sympathy.

" The stars of midnight shall be dear
To her; and she shall lean her ear,
In many a secret place,
Where rivulets dance their wayward round;
And beauty, born of murmuring sound,
Shall pass into her face.

" And vital feelings of delight
Shall rear her form to stately height,
Her virgin bosom swell;
Such thoughts, to Lucy I will give,
While she and I together live,
Here in this happy dell."

Thus Nature spake—The work was done.
How soon my Lucy's race was run !
She died, and left to me
This heath, this calm, and quiet scene ;
The memory of what has been,
And never more will be.

BYRON.

Lord Byron was born in 1788, and died in 1824. He wrote largely during his short life—his works being chiefly lyrical, dramatic, and lyrico-epic. He possesses great passion, pathos, and power of language; but the moral character of many of his works is generally unworthy of a mind otherwise so great.

To Hesperus.—(*Don Juan*, Canto III.)

O Hesperus ! thou bringest all good things—
Home to the weary, to the hungry cheer,
To the young bird the parent's brooding wings,
The welcome stall to the o'er-laboured steer ;
Whate'er of peace about our hearthstone clings,
Whate'er our household gods protect of dear,
Are gathered round us by thy look of rest ;
Thou bring'st the child, too, to the mother's breast.

Soft hour ! which wakes the wish and melts the heart
Of those who sail the seas, on the first day
When they from their sweet friends are torn apart ;
Or fills with love the pilgrim on his way
As the far bell of vesper makes him start,
Seeming to weep the dying day's decay ;
Is this a fancy which our reason scorns?
Ah ! surely nothing dies, but something mourns !

The Sea.—(*Childe Harold.*)

Roll on, thou deep and dark blue Ocean—roll :
Ten thousand fleets sweep over thee in vain ;

Man marks the earth with ruin—his control
Stops with the shore ; upon the watery plain
The wrecks are all thy deed, nor doth remain
A shadow of man's ravage, save his own,
When, for a moment, like a drop of rain,
He sinks into thy depths with bubbling groan—
Without a grave, unknell'd, uncoffin'd, and unknown.

. . . . .

Thou glorious mirror, where the Almighty's form
Glasses itself in tempests ; in all time,
Calm or convulsed—in breeze, or gale, or storm,
Icing the pole, or in the torrid clime
Dark-heaving ; boundless, endless, and sublime—
The image of Eternity—the throne
Of the Invisible ; even from out thy slime
The monsters of the deep are made ; each zone
Obeys thee ; thou goest forth, dread, fathomless, alone.

THE SHIPWRECK.—(*Don Juan.*)

THEN rose from sea to sky the wild farewell—
Then shriek'd the timid, and stood still the brave—
Then some leap'd overboard with dreadful yell,
As eager to anticipate their grave ;
And the sea yawn'd around her like a hell,
And down she suck'd with her the whirling wave,
Like one who grapples with his enemy,
And strives to strangle him before he die.

And first one universal shriek there rush'd,
Louder than the loud ocean, like a crash
Of echoing thunder ; and then all was hush'd,
Save the wild wind and the remorseless dash
Of billows ; but at intervals there gush'd,
Accompanied with a convulsive splash,
A solitary shriek, the bubbling cry
Of some strong swimmer in his agony.

THE NIGHT BEFORE WATERLOO.—(*Childe Harold.*)

THERE was a sound of revelry by night,
And Belgium's capital had gather'd then

Her beauty and her chivalry ; and bright
The lamps shone o'er fair women and brave men :
A thousand hearts beat happily ; and when
Music arose, with its voluptuous swell,
Soft eyes look'd love to eyes which spake again,
And all went merry as a marriage-bell :—
But hush ! hark ! a deep sound strikes like a rising knell !

Did ye not hear it ? No ; 'twas but the wind,
Or the car rattling o'er the stony street—
On with the dance ! Let joy be unconfined ;
No sleep till morn, when Youth and Pleasure meet
To chase the glowing hours with flying feet.
But hark ! that heavy sound breaks in once more,
As if the clouds its echo would repeat,
And nearer, clearer, deadlier than before !
Arm ! arm !—It is, it is the cannon's opening roar.

Within a window'd niche of that high hall
Sate Brunswick's fated chieftain ; he did hear
That sound the first amid the festival,
And caught its tone with Death's prophetic ear ;
And when they smiled because he deem'd it near,
His heart more truly knew that peal too well
Which stretch'd his father on a bloody bier,
And roused the vengeance blood alone could quell ;
He rush'd into the field, and, foremost fighting, fell !

Ah ! then and there was hurrying to and fro,
And gathering tears, and tremblings of distress,
And cheeks all pale, which but an hour ago
Blush'd at the praise of their own loveliness ;
And there were sudden partings, such as press
The life from out young hearts, and choking sighs
Which ne'er might be repeated. Who could guess
If ever more should meet those mutual eyes,
Since upon night so sweet such awful morn could rise ?

And there was mounting in hot haste ; the steed,
The mustering squadron, and the clattering car
Went pouring forward with impetuous speed,
And swiftly forming in the ranks of war ;

And the deep thunder, peal on peal, afar,
And near, the beat of the alarming drum
Roused up the soldier ere the morning star;
While throng'd the citizens, with terror dumb,
Or whispering with white lips, "The foe! they come! they come!"

And wild and high the "Cameron's Gathering" rose,
The war-note of Lochiel, which Albyn's hills
Have heard—and heard, too, have her Saxon foes.
How in the noon of night that pibroch thrills,
Savage and shrill! But with the breath which fills
Their mountain-pipe, so fill the mountaineers
With the fierce native daring, which instils
The stirring memory of a thousand years;
And Evan's, Donald's fame rings in each clansman's ears!

And Ardennes waves above them her green leaves,
Dewy with nature's tear-drops, as they pass,
Grieving—if aught inanimate e'er grieves—
Over the unreturning brave; alas!
Ere evening to be trodden like the grass
Which now beneath them, but above shall grow
In its next verdure, when this fiery mass
Of living valour rolling on the foe,
And burning with high hope shall moulder cold and low!

Last noon beheld them full of lusty life,
Last eve in beauty's circle proudly gay;
The midnight brought the signal sound of strife,
The morn the marshalling in arms; the day
Battle's magnificently stern array!
The thunder-clouds close o'er it, which, when rent,
The earth is cover'd thick with other clay,
Which her own clay shall cover—heap'd and pent,
Rider and horse—friend, foe,—in one red burial blent!

Thunder-Storm among the Alps.—(*Childe Harold.*)

The sky is changed!—and such a change! Oh night,
And storm, and darkness, ye are wondrous strong,
Yet lovely in your strength, as is the light
Of a dark eye in woman! Far along

There was their Dacian mother—he, their sire,
Butchered to make a Roman holiday.
All this rushed with his blood. Shall he expire,
And unavenged ? Arise, ye Goths, and glut your ire.

COLERIDGE.

COLERIDGE was born at Bristol in 1772, and died in 1834. He wrote lyrical and dramatic poems, all distinguished by profound and original thought, and powerful imagination.

HYMN BEFORE SUNRISE IN THE VALE OF CHAMOUNI.

HAST thou a charm to stay the morning star
In his steep course ? So long he seems to pause
On thy bald awful head, O sovran Blanc !
The Arve and Arveiron at thy base
Rave ceaselessly ; but thou, most awful form !
Risest from forth thy silent sea of pines,
How silently ! Around thee and above,
Deep is the air and dark, substantial, black,
An ebon mass ; methinks thou piercest it,
As with a wedge ! But when I look again,
It is thine own calm home, thy crystal shrine,
Thy habitation from eternity !
O dread and silent mount ! I gazed upon thee,
Till thou, still present to the bodily sense,
Didst vanish from my thought ; entranced in prayer,
I worshipped the Invisible alone.

. . . . .

Once more, hoar mount ! with thy sky-pointing peaks,
Oft from whose feet the avalanche, unheard,
Shoots downward, glittering through the pure serene,
Into the depth of clouds that veil thy breast—
Thou too, again, stupendous mountain ! thou,
That as I raise my head, awhile bowed low
In adoration, upward from thy base,
Slow travelling with dim eyes suffused with tears,
Solemnly seemest, like a vapoury cloud,
To rise before me.—Rise, O ever rise ;
Rise, like a cloud of incense, from the earth !

Thou kingly spirit throned among the hills,
Thou dread ambassador from earth to heaven—
Great Hierarch ! tell thou the silent sky,
And tell the stars, and tell yon rising sun,
Earth, with her thousand voices, praises God.

To Britain.—(*Ode to the Departing Year.*)

Not yet enslaved, not wholly vile,
O Albion ! O my mother isle !
Thy valleys, fair as Eden's bowers,
Glitter green with sunny showers ;
Thy grassy uplands' gentle swells
  Echo to the bleat of flocks—
Those grassy hills, those glittering dells
  Proudly ramparted with rocks—
And Ocean, 'mid his uproar wild,
Speaks safety to his island-child !
  Hence, for many a fearless age
Has social Quiet loved thy shore !
  Nor ever proud invader's rage
Or sack'd thy towers, or stained thy fields with gore.

Nature.—(*Remorse.*)

With other ministrations thou, O Nature,
Healest thy wandering and distempered child !
Thou pourest on him thy soft influences,
Thy sunny hues, fair forms, and breathing sweets,
Thy melodies of woods, and winds, and waters,
Till he relent, and can no more endure
To be a jarring and a dissonant thing
Amid this general dance and minstrelsy ;
But, bursting into tears, wins back his way,
His angry spirit healed and harmonized
By the benignant touch of love and beauty.

SHELLEY.

Shelley was born in 1792, and died in 1822. His works are chiefly lyrical. They display intense susceptibility to the beautiful, and great felicity in giving apt expression to subtle thought and delicate sentiment.

Autumn.

The warm sun is failing, the bleak wind is wailing,
The bare boughs are sighing, the pale flowers are dying,
And the year,
On the earth her deathbed, in a shroud of leaves dead,
Is lying.
Come, months, come away,
From November to May,
In your saddest array;
Follow the bier
Of the dead cold year,
And like dim shadows watch by her sepulchre.

The chill rain is falling, the night-worm is crawling,
The rivers are swelling, the thunder is knelling
For the year;
The blythe swallows are flown, and the lizards each gone
To his dwelling;
Come, months, come away,
Put on white, black, and grey,
Let your light sisters play—
To follow the bier
Of the dead-cold year,
And make her grave green with tear on tear.

The Dirge for the Old Year.

Orphan hours, the year is dead,
Come and sigh, come and weep!
Merry hours, smile instead,
For the year is but asleep:
See it smiles as it is sleeping,
Mocking your untimely weeping.

As an earthquake rocks a corse
   In its coffin in the clay,
So white Winter, that rough nurse,
   Rocks the dead-cold here to-day;
Solemn hours! wail aloud
For your mother in her shroud.

As the wild air stirs and sways
   The tree-swung cradle of a child
So the breath of these rude days
   Rocks the year: be calm and mild,
Trembling hours, she will arise,
With new love within her eyes.

January grey is here,
   Like a sexton by her grave;
February bears the bier,
   March with grief doth howl and rave,
And April weeps—but, O ye hours!
Follow with May's fairest flowers.

The Cloud.

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

. . .

THOMAS HOOD.

Thomas Hood, a minor poet of this century, is best known as a humorous writer. But many of his pieces exhibit a depth of earnest feeling, and a pathos not often surpassed.

The Deathbed.

We watched her breathing through the night,
Her breathing soft and low,
As in her breast the wave of life
Kept heaving to and fro!

So silently we seem'd to speak,—
So slowly moved about,
As we had lent her half our powers
To eke her being out!

Our very hopes belied our fears,
Our fears our hopes belied,—
We thought her dying when she slept,
And sleeping when she died!

For when the morn came, dim and sad,
And chill with early showers,
Her quiet eyelids closed—she had
Another morn than ours!

The Song of the Shirt.

With fingers weary and worn,
With eyelids heavy and red,
A woman sat in unwomanly rags,
Plying her needle and thread.
Stitch! stitch! stitch!
In poverty, hunger, and dirt,
And still with a voice of dolorous pitch
She sang the "Song of the Shirt!"

"Work! work! work!
While the cock is crowing aloof!
And work! work! work!
Till the stars shine through the roof!

It's O! to be a slave
Along with the barbarous Turk,
Where woman has never a soul to save,
If this is Christian work!

"Work! work! work!
Till the brain begins to swim;
Work! work! work!
Till the eyes are heavy and dim!
Seam, and gusset, and band,
Band, and gusset, and seam,
Till over the buttons I fall asleep,
And sew them on in a dream!

"Oh, men! with sisters dear!
Oh, men! with mothers and wives!
It is not linen you're wearing out,
But human creatures' lives!
Stitch! stitch! stitch!
In poverty, hunger, and dirt,
Sewing, at once, with a double thread,
A shroud as well as a shirt.

"But why do I talk of Death?
That phantom of grisly bone,
I hardly fear his terrible shape,
It seems so like my own—
It seems so like my own,
Because of the fasts I keep,
Oh, God! that bread should be so dear,
And flesh and blood so cheap!

"Work! work! work!
My labour never flags;
And what are its wages? a bed of straw,
A crust of bread and rags.
That shatter'd roof—and this naked floor—
A table—a broken chair!
And a wall so blank, my shadow I thank
For sometimes falling there!

"Work! work! work!
From weary chime to chime,

Work! work! work!
As prisoners work for crime!
Band, and gusset, and seam,
Seam, and gusset, and band,
Till the heart is sick, and the brain benumb'd,
As well as the weary hand.

"Work! work! work!
In the dull December light;
And work! work! work!
When the weather is warm and bright!
While underneath the eaves
The brooding swallows cling,
As if to show me their sunny backs,
And twit me with the spring.

"Oh! but to breathe the breath
Of the cowslip and primrose sweet!
With the sky above my head,
And the grass beneath my feet.
For only one short hour
To feel as I used to feel,
Before I knew the woes of want,
And the walk that costs a meal!

"Oh, but for one short hour!
A respite, however brief!
No blessed leisure for love or hope,
But only time for grief!
A little weeping would ease my heart,
But in their briny bed
My tears must stop, for every drop
Hinders needle and thread!"

With fingers weary and worn,
With eyelids heavy and red,
A woman sate in unwomanly rags,
Plying her needle and thread!
Stitch! stitch! stitch!
In poverty, hunger, and dirt,
And still with a voice of dolorous pitch,
Would that its tone could reach the rich!
She sang this "Song of the Shirt!"

LONGFELLOW.[1]

LONGFELLOW is the most popular of living American poets. He possesses an elegant fancy, and considerable felicity and melody of language. There is, however, no great profundity of thought or feeling in his works. His most ambitious pieces are Evangeline and Hiàwatha.

THE REAPER AND THE FLOWERS.

THERE is a Reaper whose name is Death,
And, with his sickle keen,
He reaps the bearded grain at a breath,
And the flowers that grow between.

"Shall I have nought that is fair?" saith he;
"Have nought but the bearded grain?
Though the breath of these flowers is sweet to me,
I will give them all back again."

He gazed at the flowers with tearful eyes,
He kissed their drooping leaves;
It was for the Lord of Paradise
He bound them in his sheaves.

"My Lord has need of these flowerets gay,"
The Reaper said, and smiled;
"Dear tokens of the earth are they
Where He was once a child.

"They shall all bloom in fields of light,
Transplanted by my care;
And saints upon their garments white,
These sacred blossoms wear."

And the mother gave, in tears and pain,
The flowers she most did love;
She knew she should find them all again
In the fields of light above.

Oh, not in cruelty, not in wrath,
The Reaper came that day;
'Twas an angel visited the green earth,
And took the flowers away.

[1] Additional specimens of Longfellow's Poems will be found in Books V. and VI. of this Series.

Burns on for evermore that quenchless flame,
  Shines on that inextinguishable light!
It sees the ocean to its bosom clasp
  The rocks and sea-sand with the kiss of peace;
It sees the wild winds lift it in their grasp,
  And hold it up, and shake it like a fleece.
The startled waves leap over it; the storm
  Smites it with all the scourges of the rain,
And steadily against its solid form
  Press the great shoulders of the hurricane.
The sea-bird wheeling round it, with the din
  Of wings and winds and solitary cries,
Blinded and maddened by the light within,
  Dashes himself against the glare, and dies.
A new Prometheus, chained upon the rock,
  Still grasping in his hand the fire of Jove,
It does not hear the cry, nor heed the shock,
  But hails the mariner with words of love.
"Sail on!" it says, "sail on, ye stately ships!
  And with your floating bridge the ocean span;
Be mine to guard this light from all eclipse,
  Be yours to bring man nearer unto man!"

TENNYSON.

TENNYSON is a living poet, and at present poet-laureate. "His mind is exquisitely poetical; his diction is often felicitous in the extreme." His susceptibility of refined emotions is delicate and profound. He belongs to the lyrical and didactic class of poets.

THE AUTUMN FLOWER-GARDEN.

A SPIRIT haunts the year's last hours,
Dwelling amid these yellowy bowers,
    To himself he talks;
For at eventide, listening earnestly,
At his work you may hear him sob and sigh
    In the walks:
    Earthward he boweth the heavy stalks
Of the mouldering flowers.

Heavily hangs the broad sunflower
Over its grave i' the earth so chilly;
Heavily hangs the hollyhock,
Heavily hangs the tiger-lily.

The air is damp, and hushed, and close
As a sick man's room when he taketh repose
An hour before death;
My very heart faints, and my whole soul grieves,
At the moist, rich smell of the rotting leaves,
And the breath
Of the fading edges of the box beneath,
And the year's last rose.
Heavily hangs the broad sunflower
Over its grave i' the earth so chilly;
Heavily hangs the hollyhock,
Heavily hangs the tiger-lily.

The Charge of the Light Brigade.

Half a league, half a league,
Half a league onward,
All in the valley of death
Rode the Six Hundred.
"Charge!" was the captain's cry,
Theirs not to reason why,
Theirs not to make reply,
Theirs but to do and die:
Into the valley of death
Rode the Six Hundred.

Cannon to right of them,
Cannon to left of them,
Cannon in front of them
Volleyed and thundered;
Stormed at with shot and shell,
Boldly they rode and well;
Into the jaws of death,
Into the mouth of hell,
Rode the Six Hundred.

Flashed all their sabres bare,
Flashed all at once in air,
Sabring the gunners there,
Charging an army, while
All the world wondered :
Plunged in the battery smoke,
Fiercely the line they broke ;
Strong was the sabre stroke :
Making an army reel
Shaken and sundered.
Then they rode back, but not—
Not the Six Hundred.

Cannon to right of them,
Cannon to left of them,
Cannon behind them
Volleyed and thundered ;
Stormed at with shot and shell,
They that had struck so well
Rode through the jaws of death,
Half a league back again,
Up from the mouth of hell,
All that was left of them—
Left of Six Hundred.

Honour the brave and bold !
Long shall the tale be told,
Yea, when our babes are old—
How they rode onward.

The Death of the Old Year.

I.

Full knee-deep lies the winter snow,
And the winter winds are wearily sighing :
Toll ye the church bells sad and slow,
And tread softly and speak low,
For the old year lies a-dying.
Old year, you must not die ;
You came to us so readily,
You lived with us so steadily,
Old year, you shall not die.

II.

He lieth still, he doth not move :
He will not see the dawn of day,
He hath no other life above.
He gave me a friend and a true, true love,
And the new year will take 'em away.
    Old year, you must not go :
    So long as you have been with us,
    Such joy as you have seen with us,
    Old year, you shall not go.

III.

He froth'd his bumpers to the brim ;
A jollier year we shall not see :
But though his eyes are waxing dim,
And though his foes speak ill of him,
He was a friend to me.
    Old year, you shall not die.
    We did so laugh and cry with you,
    I've half a mind to die with you,
    Old year, if you must die.

IV.

He was full of joke and jest,
But all his merry quips are o'er ;
To see him die, across the waste
His son and heir doth ride post-haste,
But he'll be dead before.
    Every one for his own.
    The night is starry and cold, my friend ;
    And the New Year blythe and bold, my friend,
    Comes up to take his own.

V.

How hard he breathes ! over the snow
I heard just now the crowing cock ;
The shadows flicker to and fro ;
The cricket chirps ; the light burns low :
'Tis nearly twelve o'clock.
    Shake hands before you die :
    Old year, we'll dearly rue for you,

What is it we can do for you ?
Speak out before you die.

VI.

His face is growing sharp and thin,
Alack ! our friend is gone :
Close up his eyes ; tie up his chin ;
Step from the corpse, and let him in
That standeth there alone,
And waiteth at the door.
There's a new foot on the floor, my friend,
And a new face at the door, my friend,
A new face at the door.

MISCELLANEOUS PIECES.

From the Epistle to the Countess of Cumberland.

He that of such a height hath built his mind,
And rear'd the dwelling of his thoughts so strong,
As neither fear nor hope can shake the frame
Of his resolvèd powers ; nor all the wind
Of vanity or malice pierce to wrong
His settled peace, or to disturb the same ;
What a fair seat hath he, from whence he may
The boundless wastes and wilds of man survey !

And with how free an eye doth he look down
Upon these lower regions of turmoil !
Where all the storms of passion mainly beat
On flesh and blood ; where honour, power, renown,
Are only gay afflictions, golden toil ;
Where greatness stands upon as feeble feet
As frailty doth ; and only great doth seem
To little minds, who do it so esteem.

Daniell.

Our Duty Here.

What is our duty here ? To tend
From good to better—thence to best :

Grateful to drink life's cup—then bend
Unmurmuring to our bed of rest;
To pluck the flowers that round us blow,
Scattering our fragrance as we go.

And so to live, that when the sun
Of our existence sinks in night,
Memorials sweet of mercies done
May shrine our names in memory's light;
And the blest seeds we scatter'd bloom
A hundredfold in days to come.

BOWRING.

TO BLOSSOMS.

FAIR pledges of a fruitful tree,
Why do ye fall so fast?
Your date is not so past,
But you may stay yet here awhile
To blush and gently smile,
And go at last.

What, were ye born to be,
An hour or half's delight,
And so to bid good-night?
'Twas pity Nature brought ye forth,
Merely to show your worth
And lose you quite.

But you are lovely leaves, where we
May read, how soon things have
Their end, though ne'er so brave:
And after they have shown their pride,
Like you, awhile, they glide
Into the grave.

HERRICK.

VIRTUE.

SWEET day, so cool, so calm, so bright,
The bridal of the earth and sky,
Sweet dews shall weep thy fall to-night,
For thou must die.

Sweet rose, whose hue, angry and brave,
Bids the rash gazer wipe his eye,
Thy root is ever in its grave,
And thou must die.

Sweet Spring, full of sweet days and roses,
A box where sweets compacted lie,
My music shows you have your closes,
And all must die.
Only a sweet and virtuous soul,
Like seasoned timber, never gives;
But though the whole world turns to coal,
Then chiefly lives.

GEORGE HERBERT.

CHRISTIAN DUTIES.

THOU, whose sweet youth and early hopes enhance
Thy rate and price, and mark thee for a treasure,
Hearken unto a verser, who may chance
Rhyme thee good to make a bait of pleasure:
A verse may find him who a sermon flies,
And turn delight into a sacrifice.

The cheapest sins most dearly punish'd are;
Because to shun them also is so cheap:
For we have wit to mark them, and to spare.
O crumble not away thy soul's fair heap!
If thou wilt die, the gates of hell are broad:
Pride and full sins have made the way a road.

Lie not; but let thy mouth be true to God,
Thy mouth to it, thy actions to them both:
Cowards tell lies, and those that fear the rod;
The stormy working soul spits lies and froth.
Dare to be true. Nothing can need a lie:
A fault, which needs its most, grows two thereby.

. . . .

Sum up at night what thou hast done by day;
And in the morning, what thou hast to do.
Dress and undress thy soul: mark the decay
And growth of it: if with thy watch, that too

Be down, then wind up both ; since we shall be
Most surely judged, make thy accounts agree.

HERBERT.

THE CONQUEROR'S GRAVE.

WITHIN this lowly grave a conqueror lies ;
And yet the monument proclaims it not,
Nor round the sleeper's name hath chisel wrought
The emblems of a fame that never dies—
Ivy and amaranth in a graceful sheaf
Twined with the laurel's fair, imperial leaf.
A simple name alone,
To the great world unknown,
Is graven here, and wild flowers rising round,
Meek meadow-sweet and violets of the ground,
Lean lovingly against the humble stone.

Here, in the quiet earth, they laid apart
No man of iron mould and bloody hands,
Who sought to wreak upon the cowering lands
The passions that consumed his restless heart ;
But one of tender spirit and delicate frame,
Gentlest in mien and mind
Of gentle womankind,
Timidly shrinking from the breath of blame ;
One in whose eyes the smile of kindness made
Its haunt, like flowers by sunny brooks in May ;
Yet at the thought of others' pain, a shade
Of sweeter sadness chased the smile away.

Nor deem that when the hand that moulders here
Was raised in menace, realms were chilled with fear,
And armies mustered at the sign as when
Clouds rise on clouds before the rainy east,—
Grey captains leading bands of veteran men
And fiery youths to be the vultures' feast.
Not thus were waged the mighty wars that gave
The victory to her who fills this grave :
Alone her task was wrought ;
Alone the battle fought ;

Through that long strife her constant hope was stayed
On God alone, nor looked for other aid.

She met the hosts of sorrow with a look
  That altered not beneath the frown they wore ;
And soon the lowering brood were tamed, and took
  Meekly her gentle rule, and frowned no more.
Her soft hand put aside the assaults of wrath,
      And calmly broke in twain
      The fiery shafts of pain,
And rent the nets of passion from her path.
  By that victorious hand despair was slain.
With love she vanquished hate, and overcame
Evil with good in her great Master's name.

Her glory is not of this shadowy state,
  Glory that with the fleeting season dies ;
But when she entered at the sapphire gate,
  What joy was radiant in celestial eyes !
How heaven's bright depths with sounding welcomes rung,
And flowers of heaven by shining hands were flung !
      And He who, long before,
      Pain, scorn, and sorrow bore,
The mighty Sufferer, with aspect sweet,
Smiled on the timid stranger from his seat ;
He who, returning glorious from the grave,
Dragged Death, disarmed, in chains, a crouching slave.

See, as I linger here, the sun grows low ;
  Cool airs are murmuring that the night is near.
O gentle sleeper, from thy grave I go
  Consoled though sad, in hope and yet in fear.
      Brief is the time, I know,
      The warfare scarce begun,
Yet all may win the triumphs thou hast won :
Still flows the fount whose waters strengthened thee.
  The victors' names are yet too few to fill
Heaven's mighty roll ; the glorious armoury,
  That ministered to thee, is open still.

BRYANT.

Sorrow.

He that lacks time to mourn lacks time to mend.
Eternity mourns that. 'Tis an ill cure
For life's worst ills, to have no time to feel them.
Where sorrow 's held intrusive, and turned out,
There wisdom will not enter, nor true power,
Nor aught that dignifies humanity.

Henry Taylor.

Treasure-Trove.

Through the forest idly,
As my steps I bent,
With a free and happy heart,
Singing as I went.
Cow'ring in the shade, I
Did a floweret spy,
Bright as any star in heaven,
Sweet as any eye.
Down to pluck it stooping,
Thus to me it said—
Wherefore pluck me only
To wither and to fade?
Up with its roots I dug it,
I bore it as it grew;
And in my garden-plot at home
I planted it anew.
All in a still and shady place
Beside my home so dear;
And now it thanks me for my pains,
And blossoms all the year.

From the German of Goethe.

To Autumn.

Season of mists and mellow fruitfulness!
Close bosom-friend of the maturing sun;
Conspiring with him how to load and bless
With fruit the vines that round the thatch-eaves run;
To bend with apples the moss'd cottage-trees,
And fill all fruit with ripeness to the core;
To swell the gourd and plump the hazel-shells

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