two on the eggs themselves, applicable generally to all insect eggs, which are exposed to the storms of winter. The glutinous matter by which the eggs are united, when protruded from the insect, and which is so necessary for preserving them in a mass, and for fixing them to the spot, is found, contrary to the nature of many similar substances, to be insoluble in water, and therefore incapable of being affected by the copious rains to which they are destined to be exposed. But this is not so remarkable as another fact, which has been proved by some severe tests, and which shows how admirably the constitution of these eggs is adapted to the season of winter. Both Spallanzani and Hunter made experiments to ascertain the degree of cold which the eggs of insects were capable of enduring without injury; and we subjoin the statement of the latter:—"I have exposed eggs to a more rigorous trial than the winter of 1709.* Those of several insects, and, among others, the silk-worm, moth, and elm-butterfly, were inclosed in a glass vessel, and buried five hours in a mixture of ice and sal gum *(rock salt)*. The thermometer fell 6° below zero. In the middle of the following spring, however, caterpillars came from all the eggs, and at the same time as from those which had suffered no cold. In the following year I submitted them to an experiment still more hazardous. A mixture of ice and sal gum, with the fuming spirit of nitre *(nitrate of ammonia)*, reduced the thermometer 22° below zero,—that is, 21° lower than the cold of 1709. They were not injured, as I had evident proof, by their being hatched."

It is, indeed, a singular and unaccountable fact, that the eggs of these insects are incapable of being frozen even by the intense cold now mentioned. Spallanzani discovered this, by crushing some of them with the nail, when he found that their contents remained fluid; and

* The year 1709 is celebrated for its rigour, and its fatal effects on plants and animals. Fahrenheit's thermometer fell to one degree below zero, and yet the insects were as numerous in spring as ever.

he justly infers, that the included embryos remain equally unfrozen. The final cause of this is easily understood; but the chemical property which resists so severe a trial, has not been ascertained.

The modes by which instinct has taught insects to preserve their eggs during winter, are very various. One of these I have already detailed; but, before leaving the subject, there is another which, on account of its singularity, I cannot deny myself the pleasure of mentioning; I allude to the cochineal insects *(coccidæ)*, so called from one of the species furnishing the well-known valuable dye-stuff. These little insects contrive to render their dead bodies useful to their future progeny, by protecting their eggs from the severity of the weather. They die in the act of incubation. Their eggs are deposited under their bodies, which become glued to the spot, and thus serve as a covering. In this state the dead insects appear on the bark of trees, like small warts, of various forms. The mother is seldom larger than a pepper-corn, yet the number of eggs which she lays amounts to several thousands. Some of them secrete a sort of white silky gum, very like gossamer, as the first bed of their eggs. Some naturalists have supposed this substance to be of the nature of the spider's web; but the author of "Insect Transformations" says he has ascertained it to be "precisely similar to the gluten which envelopes the eggs of most insects."

SEVENTH WEEK—WEDNESDAY.

HYBERNATION OF INSECTS.—VARIOUS STATES.

Turning from the consideration of insect eggs, let us look to some of the other means which the Creator has employed for preserving these minute animals during the rigorous season of the year. Some assume the chrysalis form, in which state they require no food, and can endure

a greater degree of cold than in their more perfect condition, though they are much inferior, in this respect, to the eggs already mentioned. We shall take an example of this method of hybernation from the butterfly family, which is remarkable for the variety of modes by which the Author of Nature has provided for the safety of the different species. The history of the large white butterfly, which we select, is not perhaps so peculiar, among the insect tribes, as it is remarkable. It undergoes a double round of transformations in the course of the year, and its instincts are wonderfully adapted to the state of the season in each. From the chrysalis state, these insects assume that of caterpillars, about the last days of April, or the beginning of the following month. They first appear on wing in the middle of May, and, about the end of the same month, lay their eggs in clusters on the under side of cabbage-leaves. In a few days after, the caterpillars come forth, and continue to feed together till the end of June, when they are at their full growth. They then wander about in search of convenient places to fix themselves, where, after their change, the chrysalis may be sheltered. When such are found, they each fasten their tail by a web, and carry a strong thread of the same round their body, near the head; and, thus firmly secured, hang a few hours, when the chrysalis becomes perfectly formed, and divested of the caterpillar's skin. In fourteen days after this, the fly is on the wing.* Such is the history of their first series of transformations. But a long period of genial weather still remains, and a new succession of changes takes place. The butterfly lays its eggs, which are again converted into caterpillars, and about the end of September, these caterpillars become chrysalides, in which state they are prepared to pass the winter. Now, however, as if acquainted with the change which nature is about to undergo, they do not seek for protection beneath the fading vegetation which formed their previous retreat, but may be found hanging under

* Goldsmith's Animated Nature, Note, vol. iv. p. 297.

the copings of garden walls, under pales, and in other places, where they can have a tolerable shelter from the inclemency of the weather, and yet be in the neighbourhood of their food, when they throw off this state of inactivity on the revival of nature in spring.

An instance of the hybernation of insects, in the *caterpillar* state, may be found in another branch of this family, that of the marsh fritillary. These small butterflies, the colour of which is a brownish orange, variegated with orange and black, are found in the caterpillar state, in the month of September. As the season advances, they spin for themselves a fine web, in which they congregate, and under covert of which they pass the winter. During this time, they are so nearly reduced to a torpid state, as to require no food; nor do they venture out of their covering, till invited by the warmth of spring. They have not yet come to their full size, and their growth is suspended during winter. If we pursue their history a little farther, we find that, about the end of April, they are in full maturity, and, suspending themselves by the tail, change into chrysalides. "Their mode of suspension," says Captain Brown, "is a singular instance of the extraordinary power of instinct. They first draw two or three small blades of grass across towards the top, and fasten them together by means of their silk, then hang themselves beneath the centre of these, each having his own little canopy. By this means, they are not only hidden from the sight of birds, but defended, in a great measure, from the damage they might otherwise sustain from windy and boisterous weather."*

In speaking of the hybernation of caterpillars, we must not forget to mention a beneficent provision by which many species are defended from the cold; we allude to the hair which at that season covers their bodies. The younger Huber found some larvæ of the smaller species of ants, which spend the winter heaped up in the lowermost floor of their dwelling; and he remarks, that "those

* Goldsmith's Animated Nature, Note, p. 298.

which are to pass the winter in this state, are covered with hair, which is not the case in summer, affording another proof of that Providence with which naturalists are struck at every step." Now, the very same thing occurs among various tribes of caterpillars, though it is by no means the case with all insects that pass the winter in this form. Even those which envelope themselves in silken shrouds, have generally this additional protection, of which the caterpillars of the brown-tail moth and mallow butterfly are instances. Some are thickly clothed with hair, a remarkable example of which occurs in the caterpillar of the drinker moth, whose very feet are covered with fine shaggy down. This insect does not become torpid in winter; and, as it feeds on grass, it can always find plenty of food. "When a fine sunny day chances to break in upon the gloom of winter, this pretty insect may be often seen stretched at its full length on a low twig, or the withered stem of a nettle, basking in the sunshine with apparent delight."*

Some insects survive the winter in their perfect state, but these are comparatively few. Several species of the genus *Vanessa* are of this number; but it is observed by Mr Rennie, that this can only be positively affirmed of the female. It is certain, however, that, even in this state, insects will bear an almost incredible degree of cold with impunity. We extract two instances recorded in the publication of Mr Rennie, on Insect Transformations, already alluded to.† "In Newfoundland, Captain Buchan saw a lake, which, in the evening, was entirely still and frozen over; but, as soon as the sun had dissolved the ice in the morning, it was all in a bustle of animation, in consequence, as was discovered, of myriads of flies let loose, while many still remained infixed and frozen round." A still more striking instance is mentioned by Ellis, in which "a large black mass, like coal or peat upon the hearth, dissolved, when thrown upon the fire, into a cloud of mosquitoes (*Culicidæ*)."

* Insect Transformations, p. 193.

† Ib. p. 406.

One other remarkable instance I shall mention, not only because it relates to another form of the hybernating principle, but also because it throws light upon a passage of Scripture, which naturalists were inclined to consider as founded on mistake. The passage is from the Proverbs of Solomon, whose wisdom and intelligence the infidel would be glad to impugn if he could: —"Go to the ant, thou sluggard; consider her ways, and be wise; which having no guide, overseer, nor ruler, provideth her meat in the summer, and gathereth her food in the harvest."* It has been alleged, that the ant has no such instinct; that indeed if she had, it would be altogether useless to her, as, in winter, she falls into a state of torpidity; and that Solomon must, therefore, have mistaken for her winter store, the larvæ of this insect, which she tends with much assiduity, and which are found carefully deposited in her nest. But it is gratifying to the pious mind to observe in how many instances the discoveries of science throw light on the difficult passages of Scripture; and prove the accuracy of its statements, even in matters of natural history, which it incidentally notices. Of these instances this is one. It is true that, in climates such as that of Europe, where the cold of winter is intense, the ant does fall into a state of torpidity; and, as if she anticipated this state, she makes no provision for the severity of winter. But it is different, at least with one species of ant, in India, named by Mr Hope the *Provision* Ant, as is stated by Mr Kirby, on the authority of Colonel Sykes. "These ants," says Mr Kirby, "after long-continued rains, during the monsoon, were found to bring up, and lay on the surface of the earth, on a fine day, their stores of grass-seeds, and grains of Guinea-corn, for the purpose of drying them. Many scores of these hoards were frequently observable on the extensive parade at Poona. This account," he adds, "clearly proves that, where the climate, and their circumstances

* Proverbs vi. 6.

require it, these industrious creatures do store up provisions." The storing propensity of the ant, thus attested, serves to indicate the accuracy of Solomon's information; and, after this discovery, there can be little doubt, that, though the naturalist, who is too little acquainted with the animals of the Holy Land, has not yet ascertained the fact by actual observation, these insects do, in that country, follow a similar instinct, during its mild winter.

The immense variety of the insect tribes, and the inexhaustible resources of the Author of Nature in accommodating their instincts and functions to their peculiar circumstances and condition, precludes the possibility of comprising any thing like a particular detail of the manner in which the various tribes are enabled to pass the winter months, within the bounds we have prescribed to ourselves. The above sketch will suffice to afford some insight into these wonderful and diversified provisions, and to direct the reader to inquiries which will amply repay his industry, and which he will find grow upon him at every step. Some observations on the hybernation of the honey-bee, the snail, and the beetle, which will be found in subsequent papers, must close my observations on this part of the history of insects. Their still more astonishing faculties and modes of existence, in the other seasons of the year, shall be considered afterwards.

SEVENTH WEEK—THURSDAY.

HYBERNATION OF BEES.

Among insects, there is none more commonly known, or more universally admired for its extraordinary instincts, than the honey-bee. Of these instincts, such as are intended for its preservation during winter, come particularly under our notice at present; but it may be

proper to premise a few words as to the general state and economy of this wonderful insect. The inhabitants of a hive have been usually divided into three distinct classes, viz. the queen, the drones, and the workers; but it has been recently discovered that there is yet another distinct class, or at least that the working-bees may be divided into two separate tribes or castes, called *Nurse-bees* and *Wax-workers*. This last distinction, which is not generally known, was ascertained by M. Huber, and is too curious to be passed over, especially as it is on the wax-workers that the provision of winter food entirely devolves. The business of the nurse-bees, which are somewhat smaller than the wax-workers, is to collect honey for the immediate subsistence of those which do not leave the hive, as well as of the young grubs, of which latter they seem to have the special charge; and also to give the finishing touches to the cells and combs left imperfect by the others. The duty of the wax-workers, on the other hand, is to provide cells, in which the queen may deposit her eggs, and reservoirs, in which they may store the honey for future use; and it has been found, by accurate observation, that the one caste does not interfere with the functions of the other. The offices of the queen and of the drones are well known, the former being the absolute monarch of the hive, and the mother of its progeny; the latter being all males, and intended by nature for the fecundation of the queen. Of the drones, it is said that there are not more than the proportion of 100 to a hive consisting of 5000 or 6000. Of the latter, though several are produced, only one is permitted to live, this autocrat bearing no rival near her throne.

Such being the remarkable constitution of this industrious community, let us now see in what manner they are directed by the Author of their instincts to secure themselves against the sterility of the winter months. First of all, it seems to be a law of this little commonwealth, that no idlers shall be permitted to exist. The

drones contribute nothing to the wealth of the hive. They have fulfilled their part as soon as the queen is rendered fruitful; and, when this important point has been gained, and the hive has been secured in the means of future increase, or, at least, before any serious and united effort is made to complete the winter's provision, the unfortunate drones are condemned to utter extermination. In July or August, the whole working-classes seem to be suddenly seized with a deadly fury towards the unproductive part of the great family. They chase their unhappy victims from every place of refuge, till at last they are brought to the bottom of the hive, where they are indiscriminately massacred, their bodies being transfixed with many wounds, and then thrown lifeless out of the hive. So great is their antipathy, at this time, to the whole race of drones, that they simultaneously destroy the male larvæ, and tear open the cocoons of their pupæ, in order to devote them to one common destruction. "This destruction of the males, however," says a writer in the Supplement to the Encyclopedia Britannica, "is not the effect of a blind and indiscriminating instinct; for, if a hive be deprived of its queen, the massacre does not take place, while the hottest persecution rages in all the surrounding hives. In this case, the males are allowed to survive one winter." The providential design of this doubtless is, that, should a young queen be reared, she may find a husband.

No sooner has the hive got rid of the incumbrance of the drones, than they commence, with the greatest assiduity, to lay up their winter stores. During the preceding months of summer, honey was to be found in great abundance, being yielded by almost every flower; and they had partly availed themselves of that season of exuberance, to replenish their cells. But they had not set about the matter in good earnest;—they had considered it as a pastime, rather than as a task:—when they poured the delicious food into their cells, it would seem to have been rather with the view of disgorging a too

plentiful meal, and of relieving themselves from the effects of gluttony, than from any care about the future. They had been luxuriating in overflowing sweets, and were little careful of a coming season of scarcity.

Now, however, the state of things is altered. Though the season is still fine, the honey-bearing flowers have begun to appear in less plenty, and much remains to be done, with diminished means. The young brood are fast vacating the cells, where they were hatched, and these cradles must now be converted into storehouses. All is bustle and animation. Not an idler is to be seen. The queen, like a presiding genius, hurries from place to place, to see that all are at their proper tasks. Some clean out the emptied cells, or rather smooth and prepare them, for the cocoons of the maggots are never removed; others repair the wax, where injured, or, if necessary, construct new depositories; while others, again, fly far and wide in search of the honey and pollen, which are to form the treasure of the hive, and to preserve them from want in the winter, and early days of the future spring. The eagerness and industry of these tiny foragers, is quite delightful. Not only do they rifle the nectaries of flowers, especially those of the clover and heath; but put in requisition the ripening fruits, when pierced by birds, and the leaves of some trees, from which a saccharine fluid, at this season, exudes, and even the honey-dew, as it is called,—an excrement emitted by the aphides.

It sometimes happens, however, that an unfavourable harvest causes all these resources to fail, and a coming famine is anticipated. The bees are then thrown upon their shifts, and the law of self-preservation overcomes the respect which they seem otherwise inclined to show to the property of their neighbours. "On these occasions," says the author of the article in the Supplement to the Encyclopedia, already alluded to, "the distressed bees often betake themselves to plunder. Spies are sent out to examine the neighbouring hives. Allured by the

smell of honey, they examine the appearance and strength of its possessors; and, selecting the weakest hive as the object of attack, they begin a furious onset, which costs great numbers their lives. If the invaders should fail in their attempt to force the entrance, they retreat, and are not pursued by those they have assailed; but if they succeed in making good the assault, the war continues to rage in the interior of the hive, till one party is utterly exterminated;—reinforcements are sent for by the invading army;—and the bees from the neighbouring hives often join the assailants, and partake of the plunder. In a short time, the whole of the enemies' magazines are completely emptied. If, on the other hand, the invaders should be defeated, the successful party is by no means safe from the attacks of the bees from other hives, if any of them should chance to have mingled in the fray, and especially if they have once penetrated as far as the magazines; for, in that case, they are sure to return, accompanied with a large reinforcement; and the unfortunate hive that has been once attacked, ultimately falls a sacrifice to those repeated invasions."

Meanwhile, the year advances, and the increasing cold warns the little commonwealth, that it is dangerous to go abroad; and, indeed, the growing deficiency of their natural food, convinces them, before the end of autumn, that the period of cessation from labour out of doors has arrived. They now live on their collected provisions, till the reduced temperature of the atmosphere causes them to lose their appetite, and to become torpid. The sleep of this little insect is by no means so deep, or so continuous, as that of many other species of animals; and, had not the Creator endowed them with the wonderful industry and forethought we have described, the whole species would soon have become extinct in this northern climate, and indeed in almost any climate of the temperate zone. Some naturalists have even disputed the fact of the torpidity of the bee, under any ordinary circumstances; while others have gone to an opposite extreme.

We believe there is no doubt, that, in an equable temperature approaching to frost, bees do become torpid,—a proof of which is to be found in the fact, that a hive, buried, in the beginning of winter, under ground, will survive till spring, when it may be disinterred in a healthy state, without much exhaustion of its winter stock. Now, it has been proved by various experiments, that a current of air through a hive is absolutely necessary to the existence of bees in their active state, and that this ventillation is kept up by means of the bees themselves, who use their wings for that purpose, which produces the humming noise to be observed in hives. Were the bees, therefore, when buried, awake and active, they would assuredly be suffocated. Several of our most celebrated naturalists, however (and, among the rest, the elder Huber), affirm positively, that bees do not become torpid in winter. He says, that the heat of a well-peopled hive is as high as 86° of Fahrenheit, even in the depth of winter, when the thermometer, in the open air, is several degrees below zero, this heat being generated by the bees clustering together, and keeping themselves in motion; and that, even in this degree of external cold, they may be heard buzzing, as they always do when ventillating the hive. Reaumur, as well as other distinguished observers, as positively maintains the opposite, and more popular, opinion. Our own belief is, that the truth lies between;—that the ordinary state of a hive, in cold weather, is, as we have already observed, a state of torpidity, but that bees are easily excited, and that, when roused, the temperature of the hive quickly rises, in proportion to their alarm or irritation. While we think, therefore, that Huber's experience may thus be accounted for, we heartily acquiesce in the following observations of Reaumur, taken as expressing the general state of a hive in winter. "It has been established," says he, "with a wisdom which we cannot but admire—with which every thing in nature has been made and ordained—that, during the greater part of the time in which the country

furnishes nothing to bees, they have no longer need to eat. The cold, which arrests the vegetation of plants,—which deprives our fields and meadows of their flowers, throws the bees into a state in which nourishment ceases to be necessary to them; it keeps them in a sort of torpidity, in which no transpiration from them takes place, or at least during which the quantity of what transpires is so inconsiderable, that it cannot be restored by aliment, without their lives being endangered."

The following humane observations, in a recent publication, are well worthy of attention, and we strongly recommend to bee-breeders the practice of Mr Nutt, as detailed by this author, by which the cruelty he deprecates may be avoided, even with profit.

"The usual practice of obtaining honey from domestic bees, was one of great, and, as it should seem, wanton and unnecessary cruelty. The little creatures, after they had toiled throughout the whole season, were not only deprived of all the winter store which they had accumulated, but they were smoked with sulphur in the hive, by means of which both old and young were entirely cut off. There is a degree of unfeeling cruelty in this, at which the mind revolts; because, though all creatures are, in *some way* or other, adapted for the use of man, the destruction of the creatures is no part of man's legitimate occupation. He has, undoubtedly, a right to his share of every production of the earth, which can in any way contribute to his comfort; but it is his duty and his interest to take that share, in wisdom, not in wantonness; and he could, upon every occasion, so manage matters, as that the quantity which he takes, might benefit that which is left; and thus, while he uses, he might ameliorate and improve all that grows and lives around him; and so be the adorner of creation, and not the destroyer.

"Many plans have been resorted to, for the preservation of bees, and the leaving of as much honey as shall support them during winter. One of the most recent, and, perhaps, the best of these, is that introduced by Mr

Nutt, a cultivator of bees in Lincolnshire, In this method, three boxes are placed together, with a door for entrance in the central box only, but with a communication between it and each of the lateral ones. By means of ventilation, the two side boxes are kept at a heat which is well adapted for labouring bees, but below that at which the young are hatched. The bees are placed, at first, in the central box only; and when the first swarm of the season is produced, and would depart, admission is given to one of the side boxes; and, when that is filled, similar admission is given into the other. The temperature of these is regulated by means of ventilators; and, when it is ascertained that one of them is full, as much ventilation is given to it, as drives all the bees into the central box; the communication between them is closed, and the box is removed, without the destruction of a single bee.

"This is not the only advantage gained; for the honey is purer, and altogether of superior quality. The low temperature of the side boxes not only prevents a queen bee from taking up her abode in them; but none of the eggs, the young, or the substances required for their nourishment in the larva state, are ever deposited in those boxes. Thus they contain only honey-cells and honey; and as those cells are constructed only as they are required, the combs are always full.

"By this means, from one swarm of bees, cultivated for five years, Mr Nutt obtained 737 lbs. of honey, and left 712 lbs. during the currency of the time for the maintenance of the bees, the increase of which was regularly progressive during the whole time, which, from its superior quality, would be worth fourteen guineas, on the average of every year, besides the expense of bringing it to market. There are very many situations in this country, where every cottager might cultivate one such establishment of bees, the profits of which would suffice to furnish himself and his family with comfortable clothing, and also to replace their household furniture."*

* Mudie's edition of Wesley's Natural Philosophy, vol. ii. pp. 264-266.

SEVENTH WEEK—FRIDAY.

HYBERNATION OF THE SNAIL.

The garden-snail has its congeners in the waters, which, in outward appearance, bear a striking resemblance to it; but its habits and instincts are quite different from those of the same genus in another element. It is admirably adapted to its mode of life, and is furnished with organs almost as complete as the largest animal; with a tongue, brain, salival ducts, glands, nerves, stomach, and intestines; with liver, heart, and blood-vessels. These it possesses in common with other animals, but it has some striking peculiarities,—one of which is, that, of four flexible horns with which it is furnished; the two uppermost are gifted with eyes, which appear like black spots on their extreme ends, and which it can hide, by a very swift contraction, in the interior of its body. Every one knows, that another peculiarity which distinguishes it from other land animals, is its shell, which it carries on its back wherever it goes, and which serves at once as its house for lodging, and as its armour for defence.

The history of this animal, so far as it suits our present purpose to advert to it, is as follows:—Each individual snail is both a father and a mother; and it lays its eggs in shady and moist hollows, which it excavates with a member which is called its foot, as by this it has the power of locomotion. These eggs are hatched, sooner or later, according to the temperature, producing little snails, exactly resembling their parent, but so delicate, that a sun-stroke destroys them, so that few, comparatively speaking, reach the end of the first year, when they are sufficiently defended by the hardness of their shell. The animal, at its first exclusion, lives solely on the pellicle of the egg from which it was produced. "Providence," as Kirby justly observes, "which, in oviparous and other animals, has provided for the first nutriment of the young in different ways, appropriating the milk of the mother to the young of quadrupeds, the yolk of the egg to those of birds, tortoises, and lizards, and the white of the egg to frogs and toads, has made this pellicle, or coat, the best nutriment of the young snail. In fact, this pellicle, consisting of carbonate of lime, united to animal substance, is necessary to produce the calcareous secretion of the mantle, and to consolidate the shell, as yet too soft for exposure." When this natural envelope is eaten, the young snail finds its nourishment in the vegetable soil around it. After the concealment of a month, it appears on the vegetable productions of the garden or meadow, which it seems indiscriminately to devour,—its house still growing with its growth, till it has completed five convolutions, by which time the animal has attained its full size.

These snails cease feeding when the first chills of autumn are felt; and, generally associating in considerable numbers, on hillocks, in the banks of ditches, or in thickets and hedges, they set about their preparations for their winter retreat. They first expel the contents of their intestines, and then, concealing themselves under moss, grass, or dead leaves, each forms, by means of its foot, and the viscid mucus which it secretes, a cavity large enough to contain its shell. The mode in which it effects this is remarkable; collecting a considerable quantity of the mucus on the sole of its foot, a portion of earth and dead leaves adheres to it, which it shakes off on one side; a second portion is again collected and deposited, and so on, till it has reared around itself a kind of wall, of sufficient height to form a cavity that will contain its shell; and then, by turning itself round, it presses against the sides, which renders them smooth and firm. The dome, or covering, is formed in the same way; earth is collected on the foot, which it then turns upward, and throws off by exuding fresh mucus; and this is repeated, till a perfect roof is formed. Having now completed its winter house, it draws in its foot, co-

vering it with the mantle, and opens its spiracle to draw in the air. On closing this, it forms, with its slime, a fine membrane, interposed between the mantle and extraneous substances. Soon afterwards, the mantle secretes a large portion of very white fluid over its whole surface, which instantly sets uniformly, and forms a kind of solid operculum, like plaster of Paris, about half a line in thickness, which accurately closes the mouth. When this is become hard, the animal separates the mantle from it. After a time, expelling a portion of the air it had inspired, and thus being reduced in bulk, it retreats a little further into the shell, when it forms another leaf of mucus; and it continues repeating this operation, till there are sometimes five or six of these leaves, forming cells filled with air between it and the operculum. Respiration ceases during the period of hybernation.*

The mode in which these animals escape from their winter confinement is singular:—The air which they had expired, on retiring into their shell farther and farther, remains between the different partitions of the mucous membrane above mentioned, which forms so many shells hermetically sealed;—this they again inspire, and thus acquiring fresh vigour, each separate partition, as they proceed, is broken by the pressure of the foot, projected in part through the mantle;—when arrived at the operculum, they burst in by a strong effort, and finally detaching it, then emerge, begin to walk, and to break their long fast!

"In all these proceedings," observes Mr Kirby, after recording the above details, "the superintending care and wise provisions of a Father-Being are evident. This creature can neither foresee the degree of cold to which it may be exposed in its state of hybernation, nor know by what means it may secure itself from the fatal effects it would produce upon it, if not provided against.

"But, at a destined period, often when the range of

* Goldsmith is mistaken when he says, that the snail opens an air-hole into its shell.—*Gaspard and Bell; Zoological Journal*, i. 93; ii. 174.

the thermometer is high, not stimulated by a cold atmosphere,—except perhaps by the increasing length of the night,—at the bidding of some secret power, it sets about erecting its winter dwelling; and, employing its foot, not only as a shovel to make its mortar, but as a hod to transport it, and a trowel to spread it duly and evenly, at length finishes and covers in its snug and warm retreat; and then, still farther to secure itself from the action of the atmosphere, with the slimy secretion with which its Maker has gifted it, fixes partition after partition, and fills each cell, formed by it, with air, till it has retreated as far as it can from every closed orifice of its shell, and thus barricades itself against a frozen death. Again, in the spring, when the word is spoken,—*Awake, thou that sleepest*, it begins immediately to act with energy; it re-inspires, as above related, the air stored in its cells; bursts all its cerements; returns to its summer haunts, and again lays waste our gardens."*

SEVENTH WEEK—SATURDAY.

HYBERNATION OF THE BEETLE.—ANIMALCULES IN PASTE.

Among insects, the beetle has some peculiar instincts, which will come more properly under our observation at another season. At present, I shall only mention three instances of remarkable habits relating to the state of particular species of this insect in winter. Beetles, it may be premised, are distinguished from other tribes of the same order, by being furnished with cases to cover two transparent wings. Like other insects, they are bred from eggs, which first become grubs; then chrysalides, in which parts of the future fly are distinctly seen; and, lastly, assuming their perfect or *imago* state, they acquire wings, and mount into the air.

The first species of this little animal which I shall introduce to the notice of my readers, is the May-bug, or

* Kirby's Bridgewater Treatise, pp. 285-289.

Dorr-beetle, well known to children by its evening buzz during the months of summer. In its maggot state, in which it remains, without any other change than increase of size and the annual renewal of its skin, for no less a period than three years, it burrows under ground, so near the surface, as to devour the roots of plants, on which it feeds voraciously, and without discrimination. When largest, it is found an inch and a half long, of a whitish-yellow colour, with a body consisting of twelve segments or joints, on each side of which there are nine breathing holes, and three red feet; but it is destitute of eyes, having no occasion for them in its natural habitation, where light does not penetrate,—here exhibiting a new and remarkable instance of the attention of the Creator, in adapting the faculties of creatures to the situation for which they are destined, as well in what he withholds as in what he grants.

At the end of the fourth year of its existence, it begins to provide itself a secure winter habitation, with a view to its future condition. About the latter end of August, it seems first to come under the influence of that extraordinary instinct, which leads it to prepare for its important change. It then buries itself deeper and deeper in the earth, sometimes, in favourable situations, to the depth of six feet, and there forms for itself a capacious apartment, the walls of which it renders very smooth and shining, by the exertions of its body. Its abode being thus formed, it begins soon after to shorten itself, to swell, and to burst its last skin, in order to assume the form of a chrysalis. This, in the beginning, appears of a yellowish colour, which heightens by degrees, till at last it appears nearly red. Its exterior form plainly discovers all the vestiges of the future winged insect, the entire fore-parts being distinctly seen; while, behind, the animal seems as if wrapped in swaddling-clothes.

The young May-bug continues in this state for nearly three months, and then divests itself of all its impediments, and becomes a winged insect, completely formed.

This happens about the beginning of the year; but it is not yet time for it to emerge into open day, the season of the year being unpropitious to its new habits. Unlike most other insects, therefore, which, immediately after their change, enter at once into all the enjoyments of their new being, it remains in a state of infant imbecility for four months longer, during which time, though without food, it gradually acquires firmness and vigour; and, about the end of May, when the genial season has returned, it works its way to the light and warmth of the summer's atmosphere, where, from living for four years under ground, and feeding only on roots, it buzzes joyfully through the mild air, having the sweetest vegetables for its banquet, and the dew of evening for its drink.

Another insect, allied to the beetle kind, is still more remarkable in its instincts, if any thing in this world of wonders can be said to have the pre-eminence: I allude to the nut-weavil *(Curculio bucum)*. Dr Good has chosen this little creature as an illustration of the absurdity of the hypothesis, which makes instinct to depend on imitation, education, or reasoning; and, assuredly, even though the supposition were not contradicted by almost every habit and pursuit of the inferior creation, this instance might of itself be sufficient to show the untenable nature of the theory. The nut-weavil, "with a finished knowledge of the art," as Dr Good expresses it, "singles out a nut in the month of August, while its shell is yet soft and penetrable; and, having prepared to deposit her eggs, pierces it with her proboscis, and then, turning round accurately, drops an egg into the minute perforation. Having accomplished this, she passes on, pierces another nut, drops another egg, and so continues, till she has exhausted her whole stock. The nut continues to grow; the egg is soon hatched; the young maggot finds its food already ripened, and in waiting for it; and, about the time of its full growth, falls with the mature nut to the ground, and at length, when its provision here

is exhausted, creeps out, by gnawing a circular hole in its side. It then burrows under the surface of the ground, where it continues dormant for eight months, at the termination of which it casts its skin, becomes a chrysalis of the general shape and appearance of the beetle kind, and, in the beginning of August, throws off the chrysalid investment, creeps to the surface of the ground, finds itself accommodated with wings, becomes an inhabitant of the air, and instantly pursues the very same train of actions, to provide for a new progeny, which had been pursued by the parent insect of the year before."

One more example which I shall notice, of the habits of particular species of the remarkably varied class of beetles, is of a very different kind; and my object, in adverting to it, is to show another principle, by which the sterility of winter is rendered innoxious to certain animals. We have seen instances in which, among vertebrated as well as invertebrated beings, the expedient of torpidity is resorted to by the Author of Nature, to sustain life, and perhaps enjoyment also, during this rigorous season. But, in the example I am going to produce, there appears to be no need of this suspension of motion and external sensation, as the little creature is able to survive a whole winter, and even much longer, without any food whatever, except what is derived from the atmosphere; and this, indeed, is a property which belongs to various classes of the invertebrated genus. The account is taken from the communication of a writer in the Philosophical Transactions:—"On the removal of a large leaden cistern, I observed, at the bottom of it, black beetles. One of the largest I threw into a cup of spirits,—it being the way of killing and preparing insects for my purpose. In a few minutes, it appeared to be quite dead. I then shut it up in a box, about an inch and a half in diameter, and, throwing it into a drawer, thought no more of it for two months; when, opening the box, I found it alive and vigorous, though it had no food all the time, nor any more air than it

could find in so small a box, whose cover shut very close. A few days before, a friend had sent me three or four cockroaches. These I had put under a large glass; I put my beetle among them, and fed them with green ginger, which they ate greedily; but he would never taste it, for the five weeks they lived there. The cockroaches would avoid the beetle, and seemed frightened at his approach; but he usually stalked along, not at all regarding whether they came in his way or not. During the two years and a half that I have kept him, he has neither ate nor drank.

"How, then, has he been kept alive? Is it by the air? There are particles in this, which supply a growth to some species of plants, as sempervivum, orpine, and house-leek. May not the same or like particles supply nourishment to some species of animals? In the amazing plan of Nature, the animal, vegetable, and mineral kingdoms, are not separated from each other by wide distances; indeed, their boundaries differ from each other by such minute and insensible degrees, that we cannot find out certainly where the one begins, or the other ends. As the air, therefore, nourishes some plants, so it may nourish some animals; otherwise, a link would seem to be wanting in the mighty chain of beings. It is certain, camelions and snakes can live many months without any visible sustenance, and probably not merely by their slow digestion, but rather by means of particles contained in the air, as the beetle did; yet, doubtless, in its natural state, it used more substantial food. So the plants above mentioned thrive best with a little earth, although they flourish a long time, and send forth branches and flowers, when they are suspended in the air. Even in the exhausted receiver, after it had been there half an hour, it seemed perfectly unconcerned, walking about as briskly as ever; but, on the admission of the air, it seemed to be in a surprise for a minute."

It is impossible not to view with wonder and admiration, the various ways in which animal life is sustained.

sometimes even under circumstances which, arguing from ordinary analogies, would seem to insure its destruction. I have already alluded to the power possessed by some insects' eggs, to resist extreme cold; and, before passing to the hybernation of higher species, I shall conclude this paper by remarking, that there are some very minute kinds of animalcules, the germs of which seem capable of resisting the extremes both of heat and cold. If the paste of flour, which has been boiled ever so long in the making, be allowed to become sour, and then be mixed with water, the mixture, when a microscope of sufficient magnifying power is applied to it, will appear to be composed, almost entirely, of little eels, very handsomely formed, and moving about with great activity. Allow the same mixture of paste and water to become solid by drought, or by freezing, and let it be again moistened or thawed, and it will be as completely peopled as ever, with its microscopic inhabitants. Now, as it would be quite unphilosophical to admit the principle of equivocal generation, we are bound to conclude, that the germs of these living creatures were lodged in the mixture, before it was subjected to the process of boiling, and were only developed by the subsequent fermentation; so that it would appear, in this case, that the principle of life, in whatever form it may exist, is indestructible by very great alternations of heat and cold; and, indeed, we are not warranted to affix boundaries to this power, or to conclude, from the experiments which have yet been made, that any length of time, however extended, or any degree of heat or cold, however great, would be sufficient to destroy the vitality of these germs.

The wonders, indeed, which an examination of the incalculably numerous and amazingly diversified classes of invertebrated animals discloses, grow upon us in every direction as we proceed; and the pious exclamation of the psalmist recurs to us perpetually,—"O Lord, how manifold are Thy works! In wisdom hast Thou made them all."

EIGHTH WEEK—SUNDAY.

GREATNESS OF GOD EVEN IN THE SMALLEST THINGS.

The following reflections of Mr Sturm, the well known popular German writer, are so appropriate, as a sequel to our observations in the course of the preceding week, as well as to the previous notices respecting the wonders of the microscope, that I think it would not be easy to direct my readers to a more suitable subject of consideration on this sacred day.

He who delights to contemplate the works of God, will not only discover his hand in those immense globes which compose the system of the universe, but also in the little worlds of insects, plants, and metals. He will search for, and adore the wisdom of God, as well in the spider's web, as in the power of gravitation, which attracts the earth towards the sun. These researches are at present the easier, as microscopes have discovered to us new scenes and new worlds, in which we behold, in miniature, whatever may excite our admiration. They who have not the opportunity of using such instruments will read at least with pleasure, the following remarks on microscopic objects.

Let us, in the first place, observe the inanimate world. Behold those mosses and little plants which God has produced in such abundance. Of what extremely small particles and fine threads are these plants composed! What a variety in their forms and shapes! Who can enumerate all their genera and all their species? Think on the innumerable multitude of small particles of which every body is composed, and which may be detached from it! If a hexagon, of an inch square, contain a hundred millions of visible parts, who can calculate all the particles which compose a mountain? If millions of globules of water may be suspended from the point of a needle, how many must there be in a spring, in a well, in a river, in

the sea? If, from a lighted candle, there issue in a second more particles of light than there are grains of sand in the whole earth, how many igneous particles must there issue from a large fire in an hour!* If one grain of sand contain more than a thousand millions of particles of air, how many must there be in the human body! If men can divide one grain of copper into millions of parts, without arriving at the first elements of matter—if odoriferous bodies can exhale a sufficiency of odorous particles, so as to be perceived at a great distance, without any sensible diminution of weight, it would require an eternity for the human mind to calculate the number of particles which exist in those bodies.

If we pass next to the animal kingdom, the scene will be incalculably extended. In summer, the air swarms with living creatures. Each drop of water is a little world full of inhabitants. Every leaf is a colony of insects; and every grain of sand is the habitation of a multitude of animated beings. Every species of plant, seed, and flower, nourishes millions of creatures.† Every person has seen those innumerable swarms of flies, gnats, and other insects, which gather together in a small space. What prodigious hosts must there be of them, that live, sport, and multiply their kind over the whole earth, and in the immense extent of the atmosphere! How many millions of still smaller insects and worms are there which crawl on the earth, or in the entrails of animals, the number of which are only known to God! With what splendour does the power of God manifest itself to the mind, when we reflect on the multitude of parts of which these creatures are composed, of whose very existence most men are ignorant! Were we not, at any time, able to prove it by experiment, could we imagine there were animals a million of times less than

* This remark proceeds, of course, on the old theory of the emanation of light and heat. But, on the undulatory theory, the wonder is not lessened. —H. D

† There seems to be somewhat of an overstatement here; but, with every abatement, the numbers of microscopic insects are incalculable.—H. D.

a grain of sand, with organs of nutrition, motion, &c. There are shell-fish so small, that, even viewed through the microscope, they appear scarcely so large as a grain of barley; and yet they are real animals, with durable dwelling-places, the foldings and recesses of which, form so many different apartments. How exceedingly small is a mite; nevertheless, this almost imperceptible point, seen through a microscope, is a hairy animal, perfect in all its members, of a regular figure, full of life and sensibility, and provided with every necessary organ. Although this animal is scarcely visible to us, yet it has a multitude of still smaller parts; and, what is yet more admirable, the glasses which show us so many faults and imperfections in the most finished works of man, can observe nothing but regularity and perfection in these microscopic objects! How inconceivably thin and tender are the threads of a spider! It has been calculated, that it would take 36,000 of them to make the thickness of a thread of common sewing silk! Each of the six papillæ from which the spider draws that glutinous liquor of which it forms its web, is composed of a thousand insensible pores, which give passage to so many threads; so that, however fine the spider's thread may appear, it is composed of 6000 smaller ones!

You are struck with astonishment: but, suppose we had microscopes which could magnify some thousands of times more than those glasses do, through which a mite appears no larger than a grain of barley, what wonders should we then see! And, even then, should we reach the limits of creation in these inconceivably small productions? Certainly not: and it would be presumption and extravagance to believe it. Each creature has a kind of infinity; and the more we contemplate the works of God, the more the wonders of his power shall be multiplied in our sight.

Our imagination is confounded in the two extremes of nature, the great and the small; and we know not whether we should admire the Divine power more in those enor-

mous masses which roll over our heads, or in those microscopic objects which are invisible to the naked eyes. Should not the contemplation of the works of God be our most pleasing occupation? The trouble of study would be amply compensated by the pure and innocent pleasures which it would afford. It would, at least, awaken in us an ardent desire to arrive in those blessed regions where we should require neither microscopes nor telescopes to enable us to discover the wondrous works of God. There all his works shall be so unveiled to our eyes, that we shall be able to distinguish the destination, structure, and relations of each object. There immortal songs of praise shall resound to the honour of the Creator of the universe. There all distinction of great and small shall be entirely done away; for every thing shall appear great in our sight, and fill our souls with admiration and joy!

EIGHTH WEEK—MONDAY.

HYBERNATION.—MIGRATION OF BIRDS.

The migration of birds, before winter deprives them of their natural food, or diminishes the temperature of the atmosphere below what their constitution is able to bear, is not only one of the familiar, but one of the most remarkable operations of this interesting class of the animal creation. No person of observation can reside long in a rural district, without being struck with the change which takes place in its feathered inhabitants about the commencement of this less genial season. While hardier races of birds, unknown to us in spring and summer, begin to appear, we lose sight of many of those tenants of our hedges and groves, which cheered us with their music, or pleased our eye by the variety and brilliancy of their plumage. They had long since almost ceased to afford us agreeable notice of their presence, by the distinctive variety of their music; but we had, only a few days or weeks before, seen them flitting gaily across our path, or perched quietly or peeringly on some neighbouring bough; yet now, neither to the eye or ear, do they any longer give indications of their existence. What has become of these interesting attendants on our summer walks? The solicitude to which reflections on their fate, during the vicissitudes of our rude winter climate, give rise, is beautifully and feelingly expressed by the Scottish poet:—

> "Ilk happing bird, wee, helpless thing,
> Which, in the merry months of spring,
> Delighted me to hear thee sing,
> What comes o' thee?
> Where wilt thou cow'r thy chittering wing,
> And close thy e'e?"

Were we, indeed, for the first time, and without the correction of experience, to witness the arrival of winter, when the bountiful hand of nature seems suddenly to be withdrawn, it would appear to us impossible that the myriads, not only of the races of insects we have been considering, but of quadrupeds, birds, and reptiles, which swarm on the surface of the earth in the more genial months of summer and autumn, should be able, during the privations of this season, to preserve their comforts, or even their very existence. There is something appalling in the idea, that such multitudes of creatures should be called into being, only to fall victims to an inevitable and cruel fate; and it would seem to reflect on the wisdom or goodness of Providence, were such anticipations to be realized. But it is not so; and the beneficent contrivances by which such a calamity is averted, tend, in no slight degree, to intimate the presence and operation of an intelligent Creator.

With regard to those animals which are actually exposed to the storms of winter, let it be observed, that this season of scarcity and privation, is immediately pre-

ceded by a period of peculiar plenty, when the edible seeds and plants are in greatest abundance; and that these, although they cease to vegetate, do not, in many instances, cease to exist as articles of food. The seeds and debris of plants lie scattered about the ground in great profusion; and, though unnoticed by us, are easily discovered by the microscopic eye of many of the inferior animals. The grass, too, which forms at once the soft carpet, and the favourite food, of so many living creatures, although faded, is still spread over our hills and valleys, and affords to the larger classes of graminivorous animals, a more scanty indeed, but yet a considerable supply of succulent food. The roots of once luxuriant plants and flowers, the fruit of the bramble, the hawthorn, and the eglantine, the acorn, the beech-mast, and even the decaying leaves of the forest, all contribute their varied nourishment to different tribes of animated beings.

But to this subject we shall afterwards have occasion more particularly to advert; and, with reference to the winged creation, we have at present to remark, that He, without whose permission "not even a sparrow falleth to the ground," and who "feedeth the ravens which have neither storehouse nor barn," deals in another manner with those tribes, to which subsistence could not now be afforded in the place of their summer residence; and, by means of a secret impulse, not less wonderful than beneficent, bears them beyond the reach of coming want, and the chilling breath of a wintry sky. The Creator is fertile in resources; and, as he has furnished this class of his living creatures with wings to travel through the air, where there are neither rivers nor seas to arrest their progress, and where they can readily overtop even the obtruding mountains, He has bestowed on them that mysterious instinct, which leads them to migrate to southern climes, where the food on which they subsist is still abundant, and the arrival of winter has only mitigated the intensity of the heat, and

rendered it to them little else than a continuance of the blessings of summer.

A continental writer has attempted to define the impulse which induces birds to migrate; but he has been forced to do so, after minute attention, more by negatives than by any positive and very intelligible assertion of a principle. "It is not want of nourishment," says M. Brehm, "for most of them commence their migration while there is still abundance in the country they are leaving. Atmospherical currents are not the cause, nor do the changes of season explain it, as the greatest number set off while the weather is yet fine; and others, as the larks and starlings, arrive while the season is bad. Atmospherical influences can only hasten the migration in autumn, but must rather retard or derange it in spring. It is the *presentiment* of what is to happen, which determines birds to begin their journey. It is an instinct which urges them, and which initiates them into the meteoric changes that are preparing. They have a particular faculty of foreseeing the rigours of the coming season; an exquisite sensibility to the perception of atmospherical changes which are not yet arrived, but are approaching."

The same intelligent and judicious writer states some facts relative to the manner of these migrations, which he conceives to be established; and, as they are curious in themselves, and condensed into few words, we shall make no apology for quoting them. "Every bird has its native country, where it freely reproduces, and remains part of the year, travelling in the remainder. Most birds spend half the year at their home, and pass the other half in travelling. Some, particularly birds of prey, travel by day, but by far the greater part travel by night; and some perform their migrations indifferently, either by day or night. They seem to pass the whole of their migration without sleep; for they employ the day in seeking their food, stopping in the places where they are most likely to find it. They commonly keep

very high in the air, and always at nearly the same distance from the earth, so that they rise very high over mountains, and fly lower along valleys. They require a wind that blows *against* them, as a contrary wind assists in raising them."*

In some subsequent papers, we shall follow out this interesting subject, by entering into a few details; but we cannot conclude this preliminary sketch, without a single remark respecting the astonishing faculty on which the migratory habits of birds are founded.

It would be vain to look for a solution of the phenomena of migration in the reasoning powers of the birds themselves. They have obviously neither a faculty of reflection, nor a geographical nor meteorological knowledge, which could enable them either to plan or to execute so astonishing an enterprise; and we are compelled to rank this means of self-preservation among the numerous habits and practices of the lower animals, which Brehm calls " a presentiment," " an instinct," " an exquisite sensibility," and which the immortal Newton justly and piously ascribes to " nothing else than the wisdom and skill of a powerful and ever-living agent."

EIGHTH WEEK—TUESDAY.

HYBERNATION.—MIGRATION OF BIRDS CONTINUED.

Curiosity has long directed its inquiries to ascertain the countries to which our various birds of passage migrate during the winter months; but it is mortifying to think how little definite information has been obtained on so interesting a question. That several of our native birds are capable of taking long and rapid flights, is generally known. The swallow and the hawk, for example, can continue on the wing, without rest, for many hours, and are believed to be capable of travelling at the amazing rate of 150 miles in the hour. Supposing, however, the average rate of the flight of birds to be only one-third of this velocity, it is obvious that they may, without difficulty, perform journeys to any extent necessary for carrying them to the warmest climates. From the British shore to the coast of France, the distance is comparatively so trifling, that, even taking the broadest part of the channel, it could, at the moderate average we have mentioned, be performed in little more than two hours; and thence again, stretching through the intervening countries of France and Spain, the journey to Africa might be accomplished in the short period of two or three days, making all reasonable allowance for needful rest. Supposing such data to be correct, this would obviously be no formidable labour; and, that we have not overstated the powers of the feathered race, may be gathered from various known facts. It is a matter of history, that a falcon belonging to Henry IV. of France, having escaped from Fountainbleau, was found, at the end of twenty-four hours, at Malta, a distance of about 1350 miles! It has been said, that birds generally begin their flight with an adverse wind; but, granting this to be the case, which we may be permitted to doubt, the intention probably is, that they may thus be assisted in rising into a higher region of the atmosphere, where they may expect to meet with a counter current; for we can scarcely suppose that they purposely encounter the disadvantage of a permanent contrary breeze; and, should the gale be favourable, they would, without any effort, except what was just necessary to keep them afloat, be borne along, with the moving element, at the rate of

* Quoted from Library of Entertaining Knowledge, on Faculties of Birds, p. 286. There appears in these remarks rather too much disposition to generalize. The author of the article from which the quotation is extracted, observes, that the last statement must be subject to some very large exceptions The same may be probably said of some of the rest; and particularly of the first, which seems to aver that *every* bird travels through part of the year.

thirty, forty, or even eighty miles an hour. As to the power of birds to keep, for a lengthened period, on wing, many remarkable facts have been mentioned. That of the blue bird of America seems to be beyond dispute, which, though one of the smaller species, passes and repasses annually, in great quantities, from the mainland to the Bermudas, a distance of not less than 600 miles, without any intervening land. "Nothing is more common in Pennsylvania," says Wilson, "than to see large flocks of these birds, in spring and fall, passing at considerable heights in the air, from the south in the former, and from the north in the latter season."

The distance to which some birds migrate from their native place, may be illustrated by the following anecdote, if it be worthy of credit, related in the article on the "Faculties of Birds," already alluded to, as found in several public journals. "Last year (1833), a Polish gentleman having caught a stork upon his estate, near Lemburg, put round its neck an iron collar, with this inscription. '*Hæc ciconia ex Polonia*' (This stork comes from Poland),—and set it at liberty. This year (1834), the bird returned to the same spot, and was again caught by the same person. It had acquired a new collar of gold, with the inscription, '*India cum donis, remittit ciconiam Polonis*' (India sends back the stork to the Poles with gifts). The gentleman having shown the inscription to his neighbours, again set the bird at liberty."

We shall not now be surprised to hear that the swallow, as well as several other British birds, such as the nightingale and the quail, should find its way to the shores of Africa. Indeed, if it possess the strength and swiftness of the American blue-bird, and there is every reason to believe that it exceeds this point rather than falls short, it would require but a small resting-place in its passage, and arrive with ease on the second day.

As to the mode of migration, this differs in different species, some assembling in vast flocks, and taking their flight together, such as swallows, geese, &c., while others seem to prefer plying their solitary way. Of this latter kind is the cuckoo, which indeed is seldom at any time observed in company even with its mate. But what would scarcely be expected, and cannot easily be accounted for on the analogy of the other habits of the feathered family, there seem to be some kinds of birds, the males of which take their migratory flight unaccompanied by the females, who follow them at the interval of some days; and others, the females of which lead the way, and leave their mates behind. The nightingale and the wheat-ear are said to be of the ungallant habits of the first mentioned species.

While those birds, whose food fails, or becomes scanty in winter, take their flight, as we have seen, to more southern climates, their place is partly supplied by the immigration of winged strangers from the shores of the north, actuated obviously by a similar impulse, namely, that of escaping from a more rigorous region, and finding a supply of congenial food, when that of their summer haunts is about to be exhausted. These are chiefly sea-fowl, or the frequenters of lakes, or the inhabitants of fens and marshes; and it is doubtless, the approach, though not perhaps the actual arrival, of frost, about to bind their more northerly places of resort in icy fetters, and thus to render them unfit for their subsistence, which has made the instinct necessary that drives them southward.

It is worthy of notice, and what might confidently be expected from the nature of the case, that although our summer visitants are not confined to any particular order or tribe, including, not only both land and water-fowl, but devourers of all different kinds of food, yet of those which reside among us, in winter, there are none insectivorous, and very few granivorous. It is also remarkable, that, while all our summer birds of passage hatch their young in this country, few, if any, of the winter kinds remain to execute this necessary duty. They leave our

shores before the breeding-season commences, to give a birth-place to their progeny in their own native regions of Sweden, Norway, or Iceland, some of them, such as the snow-bunting, even approaching the Arctic Circle, and performing the office of incubation on the ice-bound coast of Greenland, or amidst the icebergs of Spitzbergen.

It is impossible not to admire the care which Providence has thus manifested, at once to preserve the winged tribes from the fatal effects of a change of climate, too severe for their nature, and to cheer the short summer of the northern regions with the presence of inhabitants, which only a few days of a stern polar winter would destroy. The spring, summer, and autumn of Spitzbergen, for example, are all comprised in the space of a few weeks. Even so late as the end of April, the whole island is a wild and dreary waste of ice and snow; not a sound of animated beings is to be heard; though the sun, after an absence of four dismal months, has appeared for some time, skirting, with his cold and languid lamp, the edge of the bleak horizon. Gradually, however, he rises higher in the southern heavens; and in May or June, his never-setting orb sheds a genial warmth through the placid air, and on the smiling earth. The change is like that of magic. The snows dissolve, and rush in torrents to the sea. The ground appears, first in spots, and then in one vast unbroken extent, along the valleys, and even on the less elevated hills. Instantly the powers of vegetation burst forth with an energy of which we can scarcely form a conception. In a few days, a land, which seemed the region of perpetual snow, is clothed with the loveliest verdure, and becomes instinct with life. The gaunt bear leaves his cave, where he had spent the winter in a happy torpidity, while numerous insects start from their winter tombs, and flutter gladly in the balmy atmosphere. It is at this auspicious period, that the snow-buntings, and perhaps some other winter birds, having lingered probably for a time in the intervening islands of

Shetland, Faroe, and Iceland, arrive on this awakened coast, which they render vocal with their song; and, while they find a congenial climate, and food adapted to their nature, immediately begin the important offices required for the propagation of the species, obtaining, in this remote island, a retreat comparatively free from the molestation of the enemies of their species. In a few weeks, the sun begins again to lose its genial warmth, and symptoms of approaching winter warn these annual visitants to return to a more temperate climate; but this interval has sufficed, not only for the hatching of the brood, but for their being reared and cherished till they have acquired a strength of wing enabling them to accompany their adventurous parents, in shaping their pathless way for hundreds of miles across a stormy and apparently shoreless ocean, without a single land-mark in the distant horizon to direct their course.

The case of the little snow-bunting is only a particular instance, though a striking one, of that wonderful instinct which belongs to so many of the feathered family. It marks, in a very lively manner, the peculiar features, the extent, and the beneficent intentions of this impulse of a wonder working power; and, while it fills the pious mind with an undefinable feeling of awe, under the sense of a present Deity, directs it to the cheering doctrines, and blessed promises, of Revealed Truth, and may well serve to increase its confidence in the never-failing protection of a reconciled Father, who bestows those secret and mysterious influences of Divine grace, through which the Christian is led "by a way which he knows not," from the wintry scenes of earth, to the glories of an eternal summer.

The snow-bird of America is another of the feathered tribe, which the hand of a beneficent Providence drives northwards to fulfil some important end. When the weather begins to be warm, the snow-bird moves towards the colder regions, and arrives about the Hudson's Bay Factory in June, whence it continues its course still far

ther north, where it breeds. This kind is so numerous as to be found scattered over the greater part, probably the whole, of the northern regions of North America, in great profusion. Speaking of this remarkable species, Mr Wilson says, "In the circuitous route I travelled, of more than 1800 miles, I never passed a day, and scarcely a mile, without seeing numbers of these birds, and frequently large flocks of several thousands."

The impulse which urges these tenants of the air to seek the wilds of the north, is evidently connected with the instinct which leads them to propagate the species; and indeed some naturalists are of opinion, that, in all instances of migration, the same instinct operates. However this may be, it is certain that these little creatures find a more secure retreat in the countries near the Arctic Circle, for the important purpose of incubation, than could readily be chosen in the circle of their summer haunts. But, while they thus escape many formidable enemies, they are probably not altogether free from danger; for their appearance will be hailed as a seasonable boon of Providence, by the scattered inhabitants of these inhospitable regions, who must find, in this annual supply of dainty food, thus mysteriously sent them by an Unseen Hand, an agreeable and wholesome variety, after being confined, during the dismal winter months, to the unvarying sameness of that coarse, unsavoury, and oily nourishment, which their rude skill extracts from the surrounding seas.

EIGHTH WEEK—WEDNESDAY.

HYBERNATION.—BIRDS WHICH PARTIALLY MIGRATE.

THERE are some of the British feathered tribes, which although they do not pass beyond the sea, are yet, to a certain extent, migratory within the bounds of the island. These are chiefly influenced in their change of residence, by the desire of finding a more remote retreat, for the purpose of incubation, or of acquiring a more plentiful supply of food, or, perhaps, in some instances, a more sheltered place of residence during the stormy months. "Of these," says Mr Rennie, "may be mentioned, in our country, the curlew and golden-plover, which in winter reside chiefly along the shores, while in summer they betake themselves to the inland lakes and moors; the lapwing, which seems to move northwards in winter; the linnet, which in that season deserts the hilly regions, and approaches the habitations of man; and the dipper, which in summer ascends the streams, towards their sources."

But it is in continental countries, and especially in America, where interminable forests are mingled with districts and bounded by regions cultivated by the labour of man, and teeming with crops of grain, that the most remarkable instances of this kind of partial migration takes place. The countless multitudes of pigeons in that country, which, at particular seasons, shift their residence in continuous and almost interminable flocks, have long been the admiration of travellers. Audubon, in his usual graphic manner, describes a flight of this tribe, of which he was an eye-witness. "In the autumn of 1813," says he, "I left my house at Henderson, on the banks of the Ohio, on my way to Louisville. In passing over the Barrens, a few miles below Hardensburgh, I observed the pigeons flying from north-east to south-west in greater numbers than I thought I had ever seen them before; and feeling an inclination to count the flocks that might pass within the reach of my eye in one hour, I dismounted, seated myself on an eminence, and began to mark with my pencil, making a dot for every flock that passed. In a short time, finding the task that I had undertaken impracticable, as the birds poured on in countless multitudes, I rose, and counting the dots then put down, found 163 had been made in twenty-one minutes. I travelled on, and still met more, the farther

they proceeded. The air was literally filled with pigeons; the light of noon-day was obscured as by an eclipse; the dung fell in spots, not unlike melting flakes of snow; and the continued buzz of wings had a tendency to lull my senses to repose." "Before sunset," he adds afterwards, "I reached Louisville, distant from Hardensburgh fifty-five miles. The pigeons were still passing in undiminished numbers, and continued to do so for three days in succession."—* * * "The atmosphere, during this time, was strongly impregnated with the peculiar odour which emanates from the species."

Though not entirely to the point we are considering, we willingly yield to the temptation of inserting a striking passage which occurs in this account:—"I cannot describe to you the extreme beauty of their aerial evolutions, when a hawk chanced to press upon the rear of a flock. At once, like a torrent, and with a noise like thunder, they rushed into a compact mass, pressing upon each other towards the centre. In these almost solid masses, they darted forward in undulating and angular lines, descended, and swept close over the earth, with inconceivable velocity, mounted perpendicularly, so as to resemble a vast column, and, when high, were seen wheeling and twisting within their continued lines, which then resembled the coils of a gigantic serpent."

These flights are, doubtless, in search of food, and may throw some light on the nature of the principle by which migrations are influenced, as they are obviously regulated by an impulse, if not observing and intelligent, at least capable of being adapted to new circumstances, and of taking advantage of new discoveries. Catesby mentions, that since the discovery of America has introduced crops of foreign grain into that once savage and uncultivated country, not only have these comparatively novel articles of food become the familiar resource of native birds from distant regions, but various species of the winged tribes, naturally strangers to that continent, have, by some means, become aware of the existence of such exotic stores, and arrive annually in numerous flocks, at the proper season, to avail themselves of this new provision for their wants. The rice-bird and the wheat-bird are of this description. The latter, if Catesby's observations be correct, has taken this new course of migration across the sea from the island of Cuba, between one and two hundred miles distant from the nearest point of the mainland, leaving that region immediately after the rice harvest, and alighting in Carolina in time to partake of the rice crop in that latter climate, and afterwards of the ripening wheat in the more northerly plains of Virginia. It is, indeed, but a few years since the wheat-birds first found their way to this latter State, where they now regularly flock at the proper season, in such numbers, as materially to interfere with the gains of the farmer.

This is a very interesting view of the nature of the winged family, and gives rise to some curious and difficult questions. By what means do birds ascertain the introduction of their proper food into these new and distant regions? How do they communicate the information to their fellows, after they have obtained it? And when once known, by what faculty is it perpetuated in the individuals, and transmitted to their posterity? Are we to believe that, like man, they make distant voyages of discovery in search of new stores; that they possess a faculty resembling that of speech, by which they convey a knowledge of the discoveries they have made; and that they are furnished with memories sufficiently retentive, and reasoning powers sufficiently strong, to enable them, from year to year, as the season returns, to profit by the new knowledge they have acquired? This seems to be Catesby's opinion; and it would, doubtless, readily account for these and various other phenomena of a similar nature, which may occur to the inquiring mind; but it seems to be so inconsistent with what is known of the limited mental powers of birds, that it will not readily be assented to, and we must, probably, look for the true

solution in some qualities bearing more resemblance to the admitted faculties of the race. If, however, we attempt to pursue the inquiry farther, we shall, perhaps, here, as in a thousand other instances, land ourselves in perplexity and darkness, and be forced to rest in the humbling conviction, that such knowledge is too high for us. When we become aware that the migratory impulse varies according to circumstances, and is modified by changes in climate or in food, whether dependant on natural causes or on the labours of civilized man, we seem to have acquired a glimmering of something like a principle of reason as applicable to that impulse. But when, on the other hand, we consider the extent to which that reasoning principle must necessarily be carried, before it can account for the phenomena,—when we recollect, that it must include some high powers of memory, reflection, and judgment, as well as considerable geographical knowledge, and an accurate acquaintance with the progress of time, as connected with the changes of the seasons and the ripening of the fruits of the earth, it seems altogether impossible to maintain this ground; and we feel compelled to fall back on our first conclusions, and to resolve the whole, or at least by far the greater part, into a power, the nature of which has hitherto eluded all attempts to analyze it, and our ignorance of which we endeavour to conceal under the name of instinct.

Here, then, we find new cause to look up with awe and adoration to the mysterious but beneficent operations of that unseen, omnipresent Intelligence, who causes "the stork in the heaven to know her appointed times, and the turtle, and the crane, and the swallow, to observe the time of their coming."

EIGHTH WEEK—THURSDAY.

HYBERNATION.—MIGRATION OF QUADRUPEDS.

The care of Providence in securing the subsistence and comfort of quadrupeds in the winter months, is not less remarkable than that which is displayed towards the feathered creation; and the modifications of their hybernating instincts, and of other arrangements, exhibit equal indications of wise and beneficent design. A striking example of that adaptation of propensities to external circumstances, which is to be found characterizing the instincts of all the orders of organized beings, occurs among the brute tribes, in the limited extent of their migratory habits. Being destitute of wings, which transport the various species of birds so expeditiously and safely through the air, they cannot leave their native haunts without difficulty and danger, arising from the rugged and intersected nature of the earth to which they are confined, and the fury of the enemies they would meet with in a journey necessarily tedious, and often unsheltered. Some quadrupeds, however, do possess this instinct in situations favourable for its exercise. In our own island, for example, the stag and the roebuck leave the higher regions on the approach of winter, and seek protection in the more sheltered plains. But it is in continental countries, where larger space is afforded, and where the variety of climate gives freer scope for the development of the principle, that migratory habits are to be chiefly expected, and it is there that they actually exist to the greatest extent. I shall confine myself, on this subject, to the quotation of an interesting passage in Mr Kirby's Bridgewater Treatise, which occurs under the head of Geographical Distribution of Animals:—

"We are next to consider those migrations that take place periodically, and usually at certain seasons of the year; the general intention of which appears to be a

supply of food, and often a temperature best suited to reproduction; Providence, in this, taking care, that their instincts shall stimulate them to change their quarters, when these two objects can be answered at the same time, and by a single removal.

"In North America, that ferocious and lion-like animal, the bison, called there the buffalo, forms regular migrations, in immense herds, from north to south, and from the mountain to the plains; and, after a certain period, returns back again. Salt springs, usually called salt-licks or salines, found in a clay compact enough for potter's clay, are much frequented by these animals; whence they are called buffalo salt-licks. Dr Richardson informs me, that the periodical movements of these animals are regulated almost solely by the pastures; when a fire has spread over the prairies, it is succeeded by a fine growth of tender grass, which they are sure to visit. How the bison discovers that this has taken place, seems not easily accounted for; perhaps stragglers from the great herds, when food grows scarce, may be instrumental to this.

"The musk-ox, a ruminating animal, between the ox and sheep, has the same habit, extending its migratory movements as far as Melville, and other islands of the Polar Sea, where it arrives about the middle of May; and going southward towards the end of September, where it has been seen as low as latitude 67° N., which, as Dr Richardson observes, approaches the northern limit of the bison. Its food, like that of the rein-deer, or *caribou*, is grass in the summer, and lichens in the winter. Its hair is very long; and,—as well as that of the bison, which has been manufactured, both in England and America, into cloth,—might be woven into useful articles. This animal inhabits, strictly, the country of the Esquimaux, and may be regarded as the gift of a kind Providence to that people, who call it *oomingmak*, and not only eat its flesh, but also the contents of its stomach, as well as those of the rein-deer, which they

call *norrooks*, which, consisting of lichens and other vegetable substances, as Dr Richardson remarks, are more easily digested by the human stomach when they are mixed with the salivary and gastric juices of a ruminating animal.

"The wild rein-deer, in North America, in the summer," as the excellent man and author lately mentioned, states, "seek the coast of the Arctic Seas. It is singular, that the females, driven from the woods by the musquitoes, migrate thither before the males, generally in the month of May (some say in April and March); while the latter do not begin their march till towards the end of June. At this time the sun has dried up the lichens on the barren grounds; and the moist pastures in the valleys of the coasts and islands* of the above seas, afford them sufficient food. Soon after their arrival, the females drop their young. They commence their return to the south in September, and reach the vicinity of the woods towards the end of October. After the rutting season, which takes place in September, the males and females live separately; the former retire deeper into the woods, while the pregnant herds of the latter remain in the skirts of the barren grounds, which abound in the rein-deer† and other lichens. In the woods, they feed on lichens which hang from the trees, and on the long grass of the swamps. The males do not usually go so far north as the females. Columns, consisting of eight or ten thousand of these *caribous*, so numerous are they in North America, may be seen annually passing from north to south in the spring, infested and attacked in their progress by numbers of wolves, foxes, and other predaceous quadrupeds, which attack and devour the stragglers.

"The prong-horned antelope,‡ as well as the rein-deer,

* There seems to be a trifling inaccuracy here. In the month of June, the ice has ceased to bridge the northern seas; and the *males* cannot reach the *islands* if they do not arrive sooner than this period.—H. D.

† Cenomyce rangiferina.—*Achar.* ‡ Antelope furcata.

appears to go northward in the summer, and return to the south in winter.

"Dr Richardson remarks to me in a letter:—'The musk-ox and rein-deer feed chiefly on lichens, and therefore frequent the barren lands and primitive rocks, which are clothed with these plants. They resort, in winter, when the snow is deep, to the skirts of the woods, and feed on the lichens which hang from the trees; but, on every favourable change of weather, they return to the barren grounds. In summer, they migrate to the moist pastures on the sea-coast, and eat grass; because the lichens on the barren lands are then parched by the drought, and too hard to be eaten. The young grass is, I suppose, better fitted for the fawns, which are dropt about the time the deer reach the coast.' In all this, we see the hand of Providence, directing them to those places where the necessary sustenance may be had."*

Mr Kirby might have added to this latter observation, another, which seems to be not less striking, and which we have already noticed, in reference to some of the winged tribes;—that the chief reason why the rein-deer is taught to seek the north for the birth-place of its young, is, that there the latter are comparatively unmolested by those ferocious beasts of prey, which inhabit the more southerly regions, and which would assuredly greatly diminish their numbers, if they did not entirely exterminate the race, were the fawns to reside in the neighbourhood of these hordes of enemies, before they had acquired sufficient swiftness and strength to elude pursuit. This provision of Providence is truly wonderful. At the time appointed for the dropping of their young, the food of the rein-deer, as well as of the musk-ox, is to be found in abundance, at a distance from the chief haunts of their natural enemies; and thus these peaceful tribes are led, by a kind of double instinct, to the preservation of their species, both as regards its maintenance and reproduction.

* Kirby's Bridgewater Treatise, vol. i. p. 94.

In speaking of the migrations of the rein-deer, I must not omit to mention a striking peculiarity, which belongs to this as well as some other of the more intelligent species of animals: their motions appear to be directed by leaders of their own species, whom they implicitly obey, and who head their march. As they are gregarious animals, such an instinct must be exceedingly useful to them, in the unfrequented wildernesses through which they travel. They will thus profit by the experience of their captain, who is always probably one of the oldest and most experienced of the herd; for, that many of the inferior animals do learn by experience, and thus show a sagacity above mere instinct, it is impossible to doubt. The same subjection to leaders, in their movements, is observable in the elephant. The Hottentots told Mr Pringle, that, in the dense thorny forests, the great bull elephants always march in the van, bursting through the jungle, treading down the prickly brushwood, and breaking off with their trunks the larger branches that obstruct their passage, while the females and younger part follow them in single file.

That the younger or more feeble should voluntarily subject themselves to the guidance of the stronger, indicates a fine instinct; but it is not so surprising in the case of the elephant, where it would appear that *all* the largest males of the herd take the precedence, as it is in the instance of the rein-deer, who seem to select a single leader, and obey him, as if he were invested with lawful authority. By what principle, whether of instinct or of something approaching nearer to the faculty of reason, this sagacious race look up, with common consent, to one individual of the herd, it seems difficult to determine; but, however this may be, it does not less display the paternal care of the Creator. Something approaching to the same habit is found in other gregarious animals. The Mongalian antelopes have their leader, whom they follow in regular files. The old ram of the flock,—the bull among the kine,—the dunghill cock, who has proved

his superior prowess and courage,—each, in its own department, exercises a sway,—approaching, in the last mentioned, to a species of petty despotism,—which indicates an inferior degree of the same principle. Indeed, were we better acquainted with the habits of gregarious animals, the remarkable property of subjection to a superior, would probably be found to be far more extended, than may at first sight appear; for, wherever living beings congregate and act in concert, some presiding intellect, if not absolutely necessary, is yet of great utility; and it is a new instance of the wisdom and benevolence of the Creator, that, where He has been pleased to bestow the social instinct, He should also have so generally bestowed a quality, by which the peace and welfare of the respective communities are essentially promoted; and that, among the various tribes of lower animals, from the mighty elephant to the tiny bee,—the most wonderful of them all,—the important principle of subordination should be so widely diffused.

EIGHTH WEEK—FRIDAY.

CHRISTMAS-DAY.

This day is usually consecrated to the remembrance or solemn celebration of our blessed Lord's nativity. Though not disposed to look with favour on the pompous ceremonials with which it is greeted by several branches of the Church, even were it clearly proved to be the true anniversary, we yet deem it a profitable and pleasing duty to turn our thoughts this morning to the great event that occurred at Bethlehem, and that was destined to usher in the dawn of our glorious day.

Who, then, was He that was born at Bethlehem, and whose birth was attended by every circumstance of poverty and meanness? The humble mother, the lowly

stable, the manger, the poorness and obscurity of the place, the absence of all public rejoicing, declared it to be no earthly prince that was born, the joy of his sceptered father, and the hope of nations; but only an infant who might, in future years, have nowhere to lay his head, and might live and die unknown. Herein lay the humiliation of God's incarnate Son. Yet the bursting of Heaven's gates at the midnight hour; the glad announcement to the awe-struck shepherds; and the enraptured song of the heavenly host singing, "Glory to God in the highest, and on earth peace, good-will toward men;" the miraculous star, and the wise men of the East bringing costly gifts, and offering them in lowly adoration,—proclaimed the advent of that celestial King who was to rule in Zion, even of the beloved Son of God, in whom He was well pleased. Humble was the guise in which the Messiah appeared, and unheeded by a sinful world the hour of His birth; but a few rays of His glory were permitted thus early to shine forth, and declare to a chosen band the secret of His greatness. The tongue of man was silent on that most joyful of all occasions; but angel harps were visibly struck to celebrate the new-born Saviour of Mankind.

And what was the life, on earth, of Him who thus came in glory and humiliation? It was that of a deliverer of man. But did He overturn the thrones of blaspheming tyranny, and hurl to the dust, with an arm of physical power, the vain pride of mortals? Did he trample down the haughty and the great, and exalt the humble poor? Did He take signal vengeance upon the crafty and blood-stained ministers of idolatry, and vindicate the majesty of Jehovah by the visible overthrow of their hideous altars and shrines? No; though the greatest of deliverers, He did none of these things. He was the meekest of the sons of men. He went about continually doing good; and, wherever He went, He scattered the heavenly light of truth. Along with the benevolence and the wisdom, He displayed also the power of the Godhead. He pro-

claimed to all that would come unto Him, the forgiveness of sins; and he healed the most loathsome and fatal bodily diseases, in token of His power to heal the great maladies of the soul. He came to overthrow the kingdom of Satan, and He showed His ability to achieve the mighty deed, by casting out the unclean spirits which executed the purposes of that evil Power. It was also His office "to bring life and immortality to light;" and to prove, by the clearest evidence, that resurrection which He taught, He raised the corpse, already mouldering in its decay, and gave back the lost and the lamented to their weeping friends. He poured on the sightless eyeball the light of day, and on the long benighted soul the cheering radiance of mercy and truth. Every word and action showed His love to man, and was fraught with the sublimest meaning.

Such was the life of the Redeemer, as it is recorded by His chosen followers,—a life which, though sketched, as it were, in outline, yet carries upon it the significant stamp of divinity. A celebrated infidel,* apparently overpowered, for the moment, by the moral beauty and harmony of the New Testament, in one of his works declares that "the inventor of the Gospel would be a more astonishing character than the hero." A nobler or more striking sentiment could scarcely have proceeded from the lips of a believer in our holy faith. Yes! the character of Jesus was unimaginable by mortal man. That humility, sustained by Divine dignity; that benevolence, so free from ostentation; that prudence, so closely conjoined with courage; that compassion for human suffering, so far removed from any tolerance of human sin; that patience and benignity; that holiness and love, which adorned the Saviour's walk on earth,—lay entirely beyond the reach of finite conception. It is the province of imagination, when called into play by some powerful emotion, to form sublime or beautiful ideal pictures from the stores furnished by our perception of material

* Rousseau.

things; to preside over the creations of the painter or the poet, who study nature and human life, in order to supply their prevailing mental power with appropriate imagery. Imagination can only arrange into new combinations the ideas drawn from this living world; its range is limited by our experience; the groups and images it creates may be new, but the constituent parts of these are solely derived from what we see and hear. Magnificent and glowing may be the ideal scenery it draws,—of superhuman excellence the moral hero that it places before the eye of the mind; but the elements of the one and of the other are merely of this earth, and are marked with the imperfection and mortal stain of all things earthly. The fine creations of a Virgil or a Plato are palpably but the imaginings of beings with limited faculties, and corrupt moral natures, whose experience is only mundane, and whose fancy is fed with the imagery of a fallen world. Who, then, *could* have conceived the character of the Son of God, manifested on earth, in human form? The materials of such a conception were unknown. They lay in the bosom of the Eternal Father, unseen, unheard of, by mortal eye or ear. Beyond the reach of the most seraphic imagination, they never could have been embodied and presented to the filmed vision of man, by any of his race. How could that Divine love, which glowed in the bosom of Jesus of Nazareth, have been imagined by one in whose heart dwelt pride, hatred, and all evil passions? Can it even yet be fathomed by the loftiest intellect? Into whose mind could it have entered to surround an imagined incarnate God with every circumstance of suffering and humiliation? Who could, in a few simple words, have drawn a picture of the human heart, the fidelity of which all are at once compelled to own? Who could have opened such a spring of consolation as that unlocked by the man Christ Jesus? Who could have discovered such a simple and efficacious remedy for the great disease of our nature as that contained in the Gospel? Who could have presented such objects

to love, such promises to hope, such solemn and elevating mysteries to faith? The Gospel an invention! Jesus Christ a fictitious character! This, unbeliever, would be a miracle of miracles; a phenomenon wholly incomprehensible; at utter variance with all we know of the human mind; plainly transcending, indeed, its loftiest efforts; an inscrutable enigma in the history of man.

Who can describe the consequences of the Redeemer's life and death? The tongues of angels would faulter and fail in the attempt. The world, with all its sin and suffering, was permitted to exist, only that Christ might proclaim and complete its salvation; and it still exists, only that it may become the wide theatre of His glory. The light from Heaven that first shone forth among the mountains of Judea, though it has often been obscured, and even disastrously eclipsed, now shines, and will continue to shine, with a far-spreading radiance. Darkness is flying before it. Idolatry is hiding her monstrous head; and nations, at length disenthralled, and joyously surprised, are stretching forth their arms to hail their rising day. The inspired record of redemption is being borne by all the winds of heaven to distant shores; and the church, in sublime hope, is waiting the result. The consequences of the Redeemer's life and death!—Their number and grandeur overpower the imagination. Who shall tell the tears that have been wiped away, the hopes that have been inspired, the guilty passions quelled, and the moral energy infused by the glad tidings of salvation? What tranquil happiness—what sanctifying devotion—what benevolent deeds and aspirations have resulted from the glorious Gospel! And O, how can we contemplate, in thought, the present and the future ransomed millions, that shall, through a rapturous eternity, encompass the throne of the Lamb, without being lost in wonder, love, and adoration!

Such are the thoughts that ought to employ us, not only as oft as this joyful anniversary comes round, but as oft as the morning dawns, or the shades of evening

close around us. On our Sabbaths, and other solemn seasons, the birth, life, and death of our Redeemer, may be dwelt upon with peculiar and blessed effect; but yet they belong to all times, and afford, on all occasions, appropriate themes of meditation. O, then, let the rising orb of day be ever linked in our minds with the Sun of Righteousness, and let the sweetest star of eve ever remind us of the Star of Bethlehem!

EIGHTH WEEK—SATURDAY.

NO SEASON UNPLEASANT TO THE CHEERFUL MIND.

This is a season set apart, by almost universal consent, in the Christian world, as a time of festivity. The friendly greetings of the season owe their origin, in a great measure, to religious feelings, although they are very seldom conducted in a religious spirit. There is much reason to regret the abuse, while we cannot condemn the principle on which the enjoyments of this anniversary were originally founded. To the Christian, the advent of the Son of God is indeed "good tidings of great joy;" and when his rejoicings truly take their rise from a grateful and pious recollection of this most glorious event, which was the harbinger of "peace on earth," and the pledge of "good will towards men," it cannot but produce a salutary effect upon the mind.

"There is something in the very season of the year," says Washington Irving, taking another view of the subject, "that gives a charm to the festivity of Christmas. At other times, we derive a great portion of our pleasures from the mere beauties of Nature. Our feelings sally forth, and dissipate themselves over the sunny landscape, and we 'live abroad and every where;'—the song of the bird, the murmur of the stream, the breathing fragrance of spring, the soft voluptuousness of sum-

mer, the golden pomp of autumn,—earth with its mantle of refreshing green, and heaven with its deep delicious blue, and its cloudy magnificence,—all fill us with mute but exquisite delight, and we revel in the luxury of mere sensation. But, in the depth of winter, when Nature lies despoiled of every charm, and wrapped in her shroud of sheeted snow, we turn for our gratifications to moral sources. The dreariness and desolation of the landscape, the short gloomy days, and darksome nights, while they circumscribe our wanderings, shut in our feelings, also, from rambling abroad, and make us more keenly disposed for the pleasures of the social circle."

There is truth in this view, as applicable to a right constituted mind; but, on the temper and feelings of the selfish and querulous, a very different effect is produced. A person of this disposition usually gives way to a feeling of bodily uneasiness, and is visibly disturbed by the coldness and fog of the atmosphere, and the unpleasant state of the ground. He exaggerates the peculiar inconveniences of the season, and invests the gloom of the long-continued storm with his own deeper gloominess. He dwells, with a sort of satisfaction, on every circumstance of annoyance, and rejects every ray of comfort; unlike the more grateful earth, that, in the midst of almost incessant darkness and storm, so soon as the sun scatters for an instant the thick clouds, is kindled into a smile, and seems to anticipate the coming gladness of spring. But these are the symptoms of a mental disease not uncommon at this period, and in this portion of the globe.

Whatever be the cause of this disorder, it is undoubtedly heightened in its virulence by the high notions and exquisite feeling of *comfort*, consequent upon the great progress of society amongst us, and the still ascending scale of our enjoyments. Our barbarian forefathers, even in the depth of winter, could repose their weary limbs upon a pillow of heath in the open air, gathering, like the oaks of their country, strength and hardihood

from the storm. They seemed utterly insensible to the numberless small discomforts that their descendants make or find in the gloomy weather and bleak dominion of winter. They had neither the defences against the inclemency of the season, nor the resources of domestic recreation that we enjoy; and yet we are apt to murmur and complain, as if our circumstances and theirs were exactly reversed. We have secure and comfortable homes, conveniences in clothing and shelter of which they never dreamed, the sweets of refined society, the mental luxury of books, and numerous fascinating amusements, equally innocent and useful; and yet, notwithstanding these multiplied blessings, we can yield to low impatience and despondency, if, haply, the wintry tempest, however magnificent and sublime in its appearance and effects, hinder our rural excursions, or transiently affect our frames with its moisture and its cold.

Into such ingratitude are we ever disposed to fall. Instead of cultivating cheerfulness at all times and in all seasons, we too frequently lapse into moroseness and melancholy. If, in place of allowing ourselves to be disturbed by any state of the weather or of the country around us, we kept steadily in view the various comforts and enjoyments within our reach at every period of the year, we should only be fulfilling an important duty; and we should also be on the surest way to attain that serenity of mind which is its own reward. That *habit* of cheerfulness would thus be formed, which constitutes no small portion of the philosophy of daily life; and cheerfulness, when once it becomes a habitual feeling, finds food and nourishment in all scenes and seasons. As the man who is keenly alive to the sublime and the beautiful in Nature frequently finds the cherished feelings of his soul ministered unto by objects that to other minds have in them nothing to attract or enliven, so the cheerful mind derives enjoyment from scenery the most unpromising, and perceives, even in the desolation of winter, a beauty and an expression of its own.

It has been said, that the bee extracts honey, and the spider poison, from the same flower; but, perhaps, with greater truth may this be figuratively affirmed of men of different dispositions, for, whatever be the condition of the fretful or the self-indulgent, the cheerful man finds the prevailing feeling of his mind reflected back upon him, as it were, from all the varied phenomena of the seasons. He looks at Nature through a medium that has to him all the effects of fabled enchantment. As the eye of the painter or the poet is quick to discern, in every landscape, the subtle elements of his creative art, so does he, by a seeming intuition,—by an almost unconscious alchymy of the mind,—select from the concomitants of every passing season all that is fitted to compensate his incidental privations, and to inspire that tempered gladness which it is his object to attain. The winds of winter may blow coldly over the ravaged earth, and bewail the departed glories of the year; the mountains may be hid from his eye in thickest clouds; the fields and groves may be verdureless and dead; but these only enhance the endearments of his home, and heighten his gratitude for all the blessings congregated there.

I have already dwelt on the peculiar delights of the domestic hearth at this season; and I need not here remark, that these can only be enjoyed in all their power, by the bosom in which contentment and tranquillity reign. The fine enjoyments of home shun the stormy breast, and take up their abode with him who is of a cheerful temper, and who finds, in "all seasons and their change," matter of gratitude and delight. Winter, "stern ruler of the inverted year," may ravage the loved scenery around his dwelling; but, within his own breast, and in his dear family circle, there reigns a summer of social and domestic joy. The glories of the calm autumnal day may have vanished; but the sublimer glories of the nocturnal heavens more frequently greet his enraptured sight, brightly beaming through the clear

frosty air. In the deadness of Nature he sees her necessary repose before another spring; the rain, the frost, and the snow, are, in his regard, sent by the Almighty Father to fertilize the soil, and herald the bounty of another harvest.

Thus it is beneficently ordained, that the happy and contented spirit should find, at all times, the means of enjoyment. The great Framer of the human mind has exquisitely adapted the external world to its various feelings and powers; and when these are in healthful action, Nature, in her wintry as well as her vernal aspects, is full of beauty and harmony. Though the flowery and the fruitful seasons of the year may be over and gone, and the blasts of winter howl among the desolate mountains, the past is without regret, the present full of enjoyment, and the future rich in hope. How should we then adore that Divine goodness, which has given us the power to enjoy the seasons as they pass in grand succession before us; and, even among the sternest scenes of winter, to behold in vision the luxuriant beauty of spring!

J. D.

NINTH WEEK—SUNDAY.

PROOFS OF DIVINE BENEVOLENCE IN THE WORKS OF CREATION.

"CONTRIVANCE proves design," argues Dr Paley; "and the prominent tendency of the contrivance indicates the disposition of the designer. The world abounds with contrivances; and all the contrivances we are acquainted with, are directed to beneficial purposes. Evil, no doubt, exists; but it is never, that we can perceive, the object of contrivance. Teeth are contrived to eat, not to ache; their aching now and then is incidental to the contrivance, perhaps inseparable from it; or even, if you will, let it be called a defect in the contrivance; but it is not the object of it. This is a distinction that well deserves being attended to. In describing implements of husbandry, you would hardly say of a sickle, that it is made to cut the reaper's fingers, though, from the construction of the instrument, and the manner of using it, this mischief often happens. But, if you had occasion to describe instruments of torture or execution, this, you would say, is to extend the sinews; this to dislocate the joints; this to break the bones; this to scorch the soles of the feet. Here pain and misery are the very objects of the contrivance. Now, nothing of this sort is to be found in the works of nature. We never discover a train of contrivance to bring about an evil purpose. No anatomist ever discovered a system of organization calculated to produce pain and disease; or, in explaining the parts of the human body, ever said, this is to irritate; this to inflame; this duct is to convey the gravel to the kidneys; this gland to secrete the humour which forms the gout. If, by chance, he come at a part of which he knows not the use, the most he can say is, that it is useless. No one ever suspects that it is put there to incommode, to annoy, or torment. Since, then, God hath called forth

his consummate wisdom to contrive and provide for our happiness; and the world appears to have been constituted with this design at first, so long as this constitution is upheld by Him, we must, in reason, suppose the same design to continue."*

This is a beautiful, and, in many respects, a just view of the constitution of nature, with reference to living beings; which, while it does not account for the origin of evil, nor vindicate its existence, yet undeniably proves benevolence in the great Creator. Had He been malevolent, we should certainly have met with malevolent contrivances; had He been indifferent to good and evil, we should not have so constantly found, in all the contrivances of nature, a regard to happiness. Still, it must never be forgotten, that the same Divine power, which called such a world as ours into existence, might have formed it free from both moral and natural evil; and this proves, beyond contradiction, that this wise and benevolent Being did not admit the presence of evil, without a wise and benevolent design, whatever that may be. Paley, in his eagerness to vindicate the Divine perfections, seems sometimes to lose sight of that important truth, and to argue as if evil were either an unavoidable incident of creation, or an effect of chance, both of which are obviously untenable positions; and, if such tendency can be discovered in the argument quoted above, I am not inclined to justify it. The fact that all the *contrivances* of Nature are benevolent, so far as they go, is all that I contend for. The existence of evil notwithstanding, is to be accounted for on another principle, the nature of which we can only understand, as I have already stated, by studying the book of Revelation.

Referring to the subject we were considering during the last week, the migration of animals, there can be no doubt, that the Creator, if He had so willed, might have constituted their frames in such a manner as to render winter as profuse of blessings to them, in their native

* Paley's Moral Philosophy, book ii. chap. 5.

haunts, as summer, and thus have prevented the necessity of the long journeys which some of them are impelled to take; that is to say, instead of contrivances to avoid or mitigate evils, He could have removed the evils themselves altogether; and, in their place, have bestowed positive enjoyment. That He has not done so, is one of those striking peculiarities in the Divine administration of which we can find no adequate solution in natural appearances, and for explanation of which, we must refer to another source. This view has already been stated; but, as it meets us at every turn, and qualifies all our reasonings, it is necessary constantly to recur to it.

Taking the constitution of Nature as we find it, we have abundant reason to perceive indications of goodness, as well as of wisdom, in the migratory propensities which the Creator has so wonderfully impressed on the winged creation, as well as in those contrivances by which the rigour of winter is softened to the various tribes who are not furnished with this resource. Besides the views of this subject already taken, there is another, which ought not to be omitted. There is a pleasure attached by the Author of our being to variety. I do not know whether or not this pleasure is felt by the inferior creation; but, assuredly, it is a constituent feature of the human mind. Now, observe one of the provisions made for the gratification of this source of enjoyment, in the changes effected by the migratory habits of birds. The very same swallows, which "twitter from the straw-built sheds" of Britain, during the summer months, delight the swarthy sons of Africa in winter, as they dart after their insect prey, along the plains of that distant continent. The same cuckoo, too, which stopped the little satchelled urchin, on his way from school, in this civilized land, that he might imitate the well-known lay, startles the ear of the young African savage, as he roams over his native wilds. The birds of Norway, Sweden, and Iceland, supply the blank made by the retiring of our summer residents; while those which leave

our shores in autumn for the south, probably only occupy the regions left vacant by the transit of the summer visitants of those countries to still more southerly latitudes. Thus a constant interchange of the feathered tribes is kept up, to attract the curiosity, and gratify the love of variety implanted in the heart of man; while these interesting tenants of the air, doubtless, fulfil another benevolent intention of their Creator, by feeding on the insects which the warm climates so abundantly produce; thus providing against their increase to such undue extent as to destroy, or materially to injure, animals of a higher grade, and disturb the beautiful balance of Nature.

But, in regarding the provisions of the God of Nature for the welfare of the animated creation during this comparatively dismal season, and tracing the hand of a beneficent Parent in the tender care which He manifests for their subsistence and comfort, we can scarcely avoid extending our thoughts farther, and raising them higher. The beautiful language of our Saviour, which affords so just and so encouraging a view of the Universal Parent, naturally occurs, in such a review, to the pious mind:—"Behold the fowls of the air; for they sow not, neither do they reap, nor gather into barns; yet your heavenly Father feedeth them. Are ye not much better than they?" Better, assuredly, in our moral and intellectual powers, if only these be properly employed; and the sentiment points obviously to the higher destiny, to which, as immortal beings, we are called, by Him who brought life and immortality to light.

The migration of birds to fairer climes, when the storms of winter gather, cannot, indeed, be said to furnish any analogy, on which we can build a solid argument for the existence of a future state; but yet there is something in the paternal feeling which it indicates, that, at least, forcibly recals the promised blessing to the mind, and affords an agreeable illustration of the revealed truth.

We can fancy the bird, borne by a secret impulse from the coming gloom and sterility of its native haunts, winging its way over sea and land, looking down with indifference on the placid expanse of the ocean, or rising far above its stormy waves; gliding, without the desire of rest or food, over flowery plains and wide-spread wastes, forests, lakes, and mountains; fixing its eager eye on the distant horizon; still onward—onward keeping its steady course; and giving no rest to its buoyant wings, or at least none except what Nature loudly demands, till it reaches the happy shore to which an unseen hand was guiding it, and a voice, unheard by the outward ear, was whispering all the while, "Behold the place of your rest." All this, which every recurring year realizes, we can paint to ourselves, and we can see, in that wonderful flight, an emblem of the race of the pious Christian, who seeks his rest in heaven. The same unseen hand is guiding him from the storms of earth, the same unheard voice communicates inwardly with his conscious soul; with a similar desire he burns; with a corresponding eagerness he pants;—but his view is not bounded by a horizon of earth; his hopes are far, far beyond the regions of the sun: To the distant heavens he directs his anxious gaze; before him still he sees a bloody track, and knows the footmarks of his crucified Redeemer; dim in the distant sky, a shining spot appears; on that spot his anxious eye is fixed; it brightens and enlarges as he advances; one struggle more;—the ties which bound him to the world are broken;—earth disappears;—he enters the portals of heaven;—he is in the arms of his Saviour—he is singing hosannahs with angels and blessed spirits before the throne of God!

NINTH WEEK—MONDAY.

MIGRATION OF FISHES.

There is yet another class of migratory creatures, which we take notice of here, although their annual journeys are not so immediately connected with temperature, and the means of subsistence, as those we have already mentioned, and although these journeys do not properly belong to this season of the year;—I allude to the inhabitants of the seas. There is indeed one analogy, by which these numerous classes are connected, in their change of place, with the migratory animals of the land—that of the instinct by which they seek for a fit place for the reproduction of the species. That this is at least one of the laws which regulate the removals of birds and beasts, Dr Jenner has very distinctly and ingeniously proved,*—showing that, when the stimulus connected with propagation is felt, they commonly seek their *summer* quarters, and, when it ceases, retire to their *winter* haunts. To whatever extent this may be the case with land animals, there can be no doubt, that such a law has a most powerful effect on those which glide through the waters of the great deep.

Of migratory fishes, the sturgeon, and its gigantic congener, the huso, are well known. This latter species is only to be found in the Caspian and Black Seas, and the rivers which flow into them. It enters the Don and Volga, in vast shoals, about the middle of winter, where it spawns, and then returns to its usual places of summer resort. The prodigious fertility of this fish, may be judged of by the circumstance, that its eggs equal nearly a third of its whole weight; and Pallas, who gives an interesting account of the mode of fishing the huso, men-

* In a paper, published after his death, in the Philosophical Transactions for 1824.

tions one which weighed no less than 2800 lbs. Of these eggs the caviare is made, which is in great demand, as an article of food, among the Russians and Turks, and on which the Greeks are said almost entirely to subsist, during their long fasts.

The cod-fish, the haddock, and the mackerel, are also different species of migratory fishes. The former of these frequent shallows and sand-banks, between the 40° and 68° of north latitude, both in the Atlantic and Pacific oceans, and is taken in immense numbers, especially on the banks of Newfoundland. This fish makes for the coast at spawning time, which takes place about the end of winter. It is said by Leuwenhoek, that there are more than nine millions of eggs in a cod-fish of the middle size. What a bountiful provision for the numerous tribes of the broad ocean, which exist by devouring the fry, &c., as they rise to maturity!

But, of all the inhabitants of the ocean, the herring is the most valuable, as affording the greatest quantity both of profitable employment, and of food to man. Three thousand decked vessels, of different sizes, besides smaller boats, are stated to be employed in the herring fishery, with a proportionable number of seamen, besides many thousands of hands, who are, at certain seasons, employed in curing them. Of this fish, Kirby gives the following interesting account.

"The *herring* belongs to the tribe called *abdominal* fishes, or those whose ventral fins are behind the pectoral, and may be said to inhabit the Arctic Seas of Europe, Asia, and America, from whence they annually migrate, at different times, in search of food, and to deposit their spawn. Their shoals consist of millions of myriads, and are many leagues in width, many fathoms in thickness, and so dense, that the fishes touch each other; they are preceded, at the interval of some days, by insulated males. The largest and strongest are said to lead the shoals, which seem to move in a certain order, and to divide into bands as they proceed, visiting

the shores of various islands and countries, and enriching their inhabitants. Their presence and progress are usually indicated by various sea birds, sharks, and other enemies. One of the cartilaginous fishes, the sea ape,* is said to accompany them constantly, and is thence called the king of the herrings. They throw off, also, a kind of oily or slimy substance, which extends over their columns, and is easily seen in calm weather. This substance, in gloomy, still nights, exhibits a phosphoric light, as if a cloth, a little luminous, were spread over the sea.

"Some conjecture may be made of the infinite number of these invaluable fishes, that are taken by European nations, from what Lacepede relates,—that, in Norway, 20,000,000 have been taken at a single fishing; that there are few years that they do not capture 400,000,000, and that, at Gottenburgh, and its vicinity, 700,000,000 are annually taken. 'But what are these millions,' he remarks, 'to the incredible numbers that go to the share of the English, Dutch, and other European nations?'

"Migrations of these fishes are stated to take place at three different times; the first, when the ice begins to melt, which continues to the end of June; then succeeds that of summer, followed by the autumnal one, which lasts till the middle of September. They seek places for spawning, where stones and marine plants abound, against which they rub themselves, alternately on each side, all the while moving their fins with great rapidity." †

The instincts and habits of the finny tribes are necessarily less known than those of the inhabitants of the land, where their motions are constantly under the eye of man; but all that we do know of them, proves that the same wonder-working and beneficent Power, which watches over, and so mysteriously guides, the living creation in the regions of earth and air, extends his go-

* Chimaera monstrosa.

† Kirby's Bridgewater Treatise, vol. i. pp. 113-115.

vernment and his paternal care to the vast ocean; adapting the various natures of the creatures, with which he has so abundantly peopled it, with consummate wisdom, to the element in which they are destined to move; providing for their reproduction, their subsistence, and their happiness, in a manner analogous to, and yet different from, that of the land tribes; and both, in their analogy and their difference, exhibiting a skill transcending all adequate expression, and filling the mind with astonishment and awe. No wonder that the Psalmist, even with his comparatively limited knowledge, should express his admiration in this glowing strain :—" 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 moving innumerable, both small and great animals. There go the ships; there is that leviathan, whom Thou hast made to play therein. These all wait upon Thee, and Thou givest them their meat in due season."

NINTH WEEK—TUESDAY.

CETACEOUS ANIMALS.*

Of the migratory inhabitants of the ocean, the most remarkable is that class of which the whale is the chief. As there are animals of a low grade, which, by their structure and amphibious habits, seem intended, by the Author of Nature, to form the link between the denizens of the land and of the sea, so it has pleased Providence to place at the top of the scale of creatures whose "home is in the deep," a gigantic race, so nearly allied to the inhabitants of the land, that many naturalists have denied

* For a great part of this paper, I have to acknowledge my obligations to Dr Bushnan, the intelligent author of the " Introduction to the Study of Nature."

it the name of fish, and have bestowed on it the somewhat awkward appellation of " beast of the ocean." Animals of this genus resemble quadrupeds, indeed, as to their structure, in many striking particulars. Like quadrupeds, they have lungs, a stomach, intestines, liver, spleen, and bladder. Like quadrupeds, too, they have a heart, with its partitions, driving warm and red blood in circulation through the body; they breathe the air; they are viviparous; and they suckle their young at the teat. Their internal parts, which bear so close a resemblance to land animals, are similarly protected from the cold, being covered, like the hog, between the skin and the muscles, with a thick coat of fat or blubber. It is this latter property which renders them valuable to man, by whom they are so pertinaciously hunted, that it is believed not one of the largest species dies a natural death in our northern seas, or arrives nearly at its natural size.

Notwithstanding their close resemblance to quadrupeds, however, in so many particulars, they are not less closely connected with the families of the sea. They are shaped as fishes; they swim with fins; they are entirely destitute of hair; they live wholly in the depths of the ocean,—qualities which, although the whale order is justly ranked by naturalists among Mammalia, have procured for them, in ordinary language, that distinctive name, by which we distinguish the finny tribes.* The various species of this animal are—the whale, and its varieties, the cachalot, the dolphin, the grampus, and the porpoise.

These cetaceous animals, as they require to breathe the air, have holes at the top of their head, called spiracles, corresponding to the nostrils of land animals, which they frequently raise above the surface of the water, and through which the air finds access to the lungs. It is through these orifices that the water-spouts of the whale are ejected, accompanied with a noise, loud as a rushing

* Goldsmith's Animated Nature.

torrent, and rising sometimes to the height of forty feet. These spouts, which have occasioned much discussion, consist merely of expired air, and watery vapour, condensed by the cold of the atmosphere.

The whale is superior to all other warm-blooded animals, both from the extent of the domain, which he has held uninterrupted from the beginning of time, and from the enormous size to which he attains.* The hippopotamus, the elephant, the crocodile, are pigmies to him; and, while they cower before the blast, he plays with the storm-vexed ocean, mounts carelessly upon the giant waves, lies like a cradled creature 'mid their dark and dismal furrows, and, defying the power of the most tempestuous seas, sinks in security to the deep profound. The strength of the whale, too, is prodigious. "A large boat," says Martins, in his voyage to Spitzbergen, "he valueth no more than dust; for he can beat it to shivers at a blow." The blows of the tail of the white shark, when hauled upon the decks of a vessel, are so tremendous, as to threaten destruction to all on board; and, while in the water, the basking shark, when harpooned, has been known to tow a vessel of seventy tons burthen, at a rapid rate, against a fresh gale, for a considerable distance.

Against these mighty animals, man wages a war so exterminating, as to have driven them from their ancient haunts, to seek for safety in the more inaccessible parts of the ocean: here, however, they are followed. The object is to obtain the great quantity of oil which is found in what is called their blubber. The quantity of this oil, procured from the great northern whale, frequently amounts to one-twelfth of the weight of its enormous carcase; the tongue alone, which has been said to be "about the size of a great feather-bed," often yielding

* The whale is said to have been found, formerly, of the amazing size of 200 and even 230 feet; but it seldom is permitted, in the present day, to escape the rapacity of man, after it has attained the length of 70 or 80 feet, except in the South Seas, where it may still be occasionally taken of double that size.

five or six barrels. Besides this mass of subcutaneous fat, many cetaceous animals, as the bottle-nosed or spermaceti whale, have a second collection of a similar substance, except that it is of a purer quality, and firmer consistence, in a large reservoir, often 16 or 18 feet long, and wide in proportion, at the top of their heads, near the spiracles or breathing-holes. This is the spermaceti of commerce.

Here we have a strong illustration of the all-provident care of the Almighty. The solid parts of the body of these animals are heavier than water; consequently, had they not been provided with a sufficient supply of some substance lighter than water, by which their tendency to sink might be counteracted, it would have required a constant effort, on their parts, to keep themselves at any given level below the water; and besides this, cetaceous animals, unlike other fishes, require frequently to be raised to the surface. It has, therefore, been wisely provided, that, while the oil of the blubber serves to render the body, collectively, lighter than the water which they inhabit, the spermaceti should render the top of the head the most buoyant part of the body; and, in this way, it is kept above the surface, without any exertion.

We are indebted to Captain Scoresby for the following interesting notices of the Greenland Whale Fisheries:—

The first impulse of the whale, when harpooned, is to plunge deep beneath the waves, going at the rate of eight or ten miles an hour, and carrying the harpoon, to which a long line is attached, still fixed in the wound. The depth to which it sometimes plunges, is 800 fathoms, and the pressure there sustained would, according to this writer, be equal to 211,200 tons,—a degree of pressure, of which we have but an imperfect conception. "It may assist our comprehension, however, to be informed, that it exceeds in weight sixty of the largest ships of the British navy, when manned, provisioned, and fitted for a six months' cruize."

"No sooner does the exhausted whale appear, than the assisting boats make for the place, with the utmost speed, and, as they reach it, each harpooner plunges his harpoon into its back, to the amount of three, four, or more, according to the size of the whale, and the nature of the situation. Most frequently, it descends for a few minutes after receiving the second harpoon, and obliges the other boats to wait its return to the surface, before any farther attack can be made. It is afterwards actively plied with lances, which are thrust into its body, aiming at its vitals. At length, when exhausted by numerous wounds, and the loss of blood, which flows from the huge animal in copious streams, it indicates the approach of its dissolution, by discharging from its blow-holes a mixture of blood, along with the air and mucus which it usually breathes out, and finally, jets of blood alone. The sea, to a great extent around, is dyed with its blood, and the ice, boats, and men, are sometimes drenched with the same. Its final capture is, at times, preceded by a convulsive and energetic struggle, in which its tail, reared, whirled, and violently jerked in the air, resounds to the distance of miles."

This animal exhibits such warm affections for its mate and its young, as to excite the strongest sympathy for its fate, in the benevolent mind; and this feeling is certainly not diminished by the circumstance, that these very affections are frequently made use of, by the heartless avarice of man, to decoy it into his power. Captain Scoresby mentions, that the cub is often attacked to lure the mother, and, when this cruel plan is adopted, it generally succeeds. "In June, 1811," says he, giving an example, "one of my harpooners struck a sucker, with the hope of its leading to the capture of its mother. Presently she arose close by the fast-boat, and, seizing the young one, dragged about 100 fathoms of line out of the boat, with remarkable force and velocity. Again she arose to the surface, darted furiously to and fro, and frequently stopped short, or suddenly changed her direction, and gave every possible intimation of extreme agony. For a length of time, she continued thus to act, though closely pursued by the boats; and, inspired with courage and resolution, by her concern for her offspring, seemed regardless of the danger that surrounded her. At length one of the boats approached so near, that a harpoon was hove at her; it hit, but did not attach itself. A second harpoon was struck; this also failed to penetrate; but a third was more effectual, and held. Still she did not attempt to escape, but allowed other boats to approach; so that, in a few minutes, three more harpoons were fastened; and, in the course of an hour afterwards, she was killed."

There is something exceedingly interesting in the fact, that, in these monsters of the ocean, the hand of the Creator has placed the same kindly and disinterested affections, which ennoble the most exalted of his creatures who tread the solid land, and claim kindred with heaven.

NINTH WEEK—WEDNESDAY.

MIGRATION OF FISHES FROM THE SEA INTO RIVERS.

With regard to the tenants of the ocean which periodically find their way into the fresh water, for the purpose of spawning, Mr Kirby gives the following interesting notices:—

"The next tribe of migratory fishes is one whose several species are intermediate between marine and fresh water fishes, roving, indifferently, in the sea, and rivers, and lakes, which thus is fitted, by Providence, to make up to the inhabitants of inland countries, their distance from the other migrators, by a supply, brought, as it were, to their very doors. The fishes in question, belong, like the herrings, to the abdominal class, and form the salmon genus, including the salmon, the salmon-

trout, the trout, the grayling, the char, the smelt, the hucho, and many other species. I shall, however, confine my observations principally to the king, as it may be called, of the river migrators,—the *salmon*. In our own country this noble fish is too high priced to form a general article of food, and may be reckoned among the luxuries of the rich man's table; but in others, especially amongst some of the North-western American tribes, they are gifts of Providence, which form their principal food at all seasons. One of these tribes, which Sir George Mackenzie fell in with, in his journey from Canada to the Pacific, were perfect ichthyophagites, and would touch no other animal food.

* * * * *

"The salmon, indeed, frequents every sea, the Arctic as well as the Equatorial; and it is found even in great lakes and inland seas, as the Caspian, into which it is even affirmed to make its way by a subterranean channel from the Persian Gulf;* it goes as far south as New Holland and the Australian Seas; but it is said never to have been found in the Mediterranean, and appears to have been unknown to Aristotle. Pliny mentions it as a river fish, preferred to all marine ones by the inhabitants of Gaul. It traverses the whole length of the largest rivers. It reaches Bohemia by the Elbe, Switzerland by the Rhine, and the Cordilleras of America by the mighty Maragnon, or river of the Amazons, whose course is nearly 3000 miles. In temperate climates, the salmon quits the seas early in spring, when the waves are driven by a strong wind against the river currents. It enters the rivers of France, in the beginning of the autumn—in September; and in Kamtschatka and North America still later.

"They rush into rivers that are freest from ice, or where they are carried by the highest tide, favoured by the wind; they prefer those streams that are most

* It is somewhat surprising to see this ridiculous fable gravely mentioned even as a report, by so judicious a naturalist as Mr Kirby.—H. D.

shaded. They leave the sea in numerous bands, formed with great regularity. The largest individual, which is generally a female, takes the lead, and is followed by others of the same sex, two and two, each pair being at the distance of from three to six feet from the preceding one; next come the old, and after them the young males, in the same order.

"The noise they make in their transit, heard from a distance, sounds like a far-off storm. In the heat of the sun, and in tempests, they keep near the bottom; at other times, they swim a little below the surface. In fair weather they move slowly, sporting as they go, at the surface, and wandering again and again from their direct route; but, when alarmed, they dart forward with such rapidity that the eye can scarcely follow them. They employ only three months in ascending to the sources of the Maragnon, the current of which is remarkably rapid,—which is at the rate of nearly forty miles a-day; in a smooth stream, or lake, their progress would increase in a fourfold ratio. Their tail is a very powerful organ, and its muscles have wonderful energy; by placing it in their mouth, they make of it a very elastic spring; for, letting it go with violence, they raise themselves in the air to the height of from twelve to fifteen feet, and so clear the cataract which impedes their course; if they fail in their first attempt, they continue their efforts till they have accomplished it.* The female is said to hollow out a long and deep excavation in the gravelly bed of the river, to receive her spawn, and, when deposited, to cover it up; but this admits of some doubt.

"Among the migrations of fishes, I must not neglect those which take place in consequence of the water in the ponds or pools that they inhabit being dried up.

* If it be true that the salmon which frequents the waters of the Maragnon can clear a cataract of fifteen feet in height, in the manner stated by Mr Kirby, it must be a much more powerful and active fish than the species found in the British rivers.—H. D.

Some of these are very extraordinary, and prove, that when the Creator gave being to these animals, he foresaw the circumstances in which they would be placed, and mercifully provided them with the means of escape from dangers to which they would be necessarily exposed.

"In very dry summers, the fishes that inhabit the above situations, are reduced often to the last extremities, and endeavour to relieve themselves, by plunging, first their heads, and afterwards their whole bodies, in the mud, to a considerable depth. * * *

"But others, when reduced to this extremity, desert their native pool, and travel in search of another that is better supplied with water. This has long been known of eels, which wind, by night, through the grass, in search of water, when so circumstanced. Dr Hancock, in the Zoological Journal, gives an account of a species of fish, called, by the Indians, the flat-head hassar, and belonging to a genus* of the family of the Siluridans, which is instructed by its Creator, when the pools in which they commonly reside, in very dry seasons, lose their water, to take the resolution of marching by land, in search of others in which the water is not evaporated. These fish, which grow to the length of a foot, travel in large droves with this view; they move by night, and their motion is said to be like that of the two-footed lizard.† A strong serrated arm constitutes the first ray of its pectoral fin. Using this as a kind of foot, it should seem, they push themselves forward, by means of their elastic tail, moving nearly as fast as a man will leisurely walk. The strong plates which envelope their body, probably facilitate their progress, in the same manner as those under the body of serpents, which, in some degree, perform the office of feet. It is affirmed by the Indians, that they are furnished with an internal supply of water, sufficient for their journey."‡

* * * *

* Doras. † Bipes. ‡ Kirby's Bridgewater Treatise, vol. i. pp. 116-122.

Mr Kirby mentions some other tribes of migrating fishes; and, among these, one found in Tranquebar, by Daldorff, which not only creeps upon the shore, but even climbs the fan-palm, in pursuit of certain crustaceans which form its food. Its structure is admirably adapted to this extraordinary instinct. The lobes of its gill-covers are so divided and armed, as to be employed together or separately, as hands, for the suspension of the animal, till, by unsheathing its dorsal and anal fins,—which at other times it folds up into the cavity of its body,—and, fixing them in the bark, it prepares to take another step.

How curious are these contrivances, and how varied the resources of the Author of Nature! The instances now mentioned, however, are, in reality, no more worthy of attention than the instincts of those animals with which we are most familiar. We are only more surprised and impressed with them on account of their peculiarity. The hand of a wonder-working God is everywhere.

NINTH WEEK—THURSDAY.

MIGRATION OF EELS.

THE following observations of Sir Humphrey Davy, in his "Salmonia," on the migration of eels, are too curious to be omitted:—

"There are two migrations of eels, one *from*, and the other *to*, the sea: the first in spring and summer; the second in autumn, or early in winter:—the first, of very small eels, which are sometimes not more than two, or two and a-half inches long; the second, of large eels, which sometimes are three or four feet long, and weigh from ten to fifteen, or even twenty pounds. There is great reason to believe, that all eels found in fresh water

are the results of the first migration.* They appear in millions in April and May, and sometimes continue to rise as late even as July and the beginning of August. I remember this was the case in Ireland in 1823. It had been a cold backward summer; and when I was at Ballyshannon, about the end of July, the mouth of the river, which had been in flood all this month, under the fall, was blackened by millions of little eels, about as long as the finger, which were constantly urging their way up the moist rocks by the side of the fall. Thousands died; but their bodies remaining moist, served as a ladder for others to make their way; and I saw them ascending even perpendicular stones, making their road through wet moss, or adhering to some eels that had died in the attempt. Such is the energy of these little animals, that they continue to find their way in immense numbers to Loch Erne. The same thing happened at the Fall of Bann, and Loch Neagh is thus peopled with them. Even the mighty Fall of Schaffhausen does not prevent them from making their way to the Lake of Constance, where I have seen many very large eels.

"There are eels in the Lake of Neufchatel, which communicates by a stream with the Rhine; but there are none on the Leman Lake, because the Rhone makes a subterraneous fall below Geneva; and though small eels can pass by moss, or mount rocks, they cannot penetrate limestone, or move against a rapid descending current of water, passing, as it were, through a pipe. Again, no eels mount the Danube from the Black Sea;

* Mr Mudie, in his volume on the "Sea," observes, that the brackish water at the mouth of rivers is warmer, by two or three degrees, than the water either in the sea itself, or in the river, a circumstance which he accounts for, by the chemical action of the saline substances in the sea on the fresh water. He supposes that eels, and other kinds of fish, resort to estuaries, on account of the warmth; and he adds, that, "in the case of the eel, this heat brings forward the spawn till it is ready to be deposited in the manner in which it is done by the generality of oviparous fishes:" and he considers this to be proved by the fact, "that the young eels are observed ascending the rivers in great numbers, during the following season, while no young eel is, at the same time, found either descending the stream, or crossing the river."—*Mudie's Sea*, p. 68.

and there are none found in the great extent of lakes, swamps, and rivers, communicating with the Danube, though some of these lakes and morasses are wonderfully fitted for them; and though they are found abundantly in the same countries, in lakes and rivers connected with the ocean and the Mediterranean; yet, when brought into confined water in the Danube, they fatten and thrive there.

"As to the instinct which leads young eels to seek fresh water, it is difficult to reason; probably they prefer warmth, and, swimming at the surface in the early summer, find the lighter water warmer, and likewise containing more insects, and so pursue the courses of fresh water, as the waters from the land, at this season, become warmer than those of the sea. Mr Couch says (*Lin. Trans.*, part 14, p. 70), that the little eels, according to his observation, are produced within reach of the tide, and climb round falls to reach fresh water from the sea. I have sometimes seen them, in spring, swimming in immense shoals in the Atlantic, in Mount Bay, making their way to the mouths of small brooks and rivers. When the cold water from the autumnal floods begins to swell the rivers, this fish tries to return to the sea; but numbers of the smaller ones hide themselves during the winter in the mud, and many of them form, as it were, masses together.

"Various authors have recorded the migration of eels in a singular way, such as Dr Plot, who, in his History of Staffordshire, says that they pass in the night, across meadows, from one pond to another;* and Mr Anderson (*Trans. Royal Soc.*) gives a distinct account of small eels rising up the flood-gates and posts of the water-works of

* There can be no doubt that eels occasionally leave the water for the land. Mr Jesse, who is an accurate inquirer, says, "Eels certainly come upon grass lands, to feed at night upon worms and snails. In the meadows at Barford, in Warwickshire, they have been cut in two by the mowers, and an old keeper there assured a friend of mine, that he had frequently intercepted them, on their way back to the river, early in the morning. Their movements on land were very quick."—*Jesse's Gleanings*, 3d series, p. 68.

the city of Norwich; and they made their way to the water above, though the boards were smooth planed, and five or six feet perpendicular. He says, when they first rose out of the water upon the dry board, they rested a little, which seemed to be till their slime was thrown out, and sufficiently glutinous, and then they rose up the perpendicular ascent as if they had been moving on a plain surface. There can, I think, be no doubt, that they are assisted by their small scales, which, placed like those of serpents, must facilitate their progressive motion. These motions have been microscopically observed by Leuwenhoek (Phil. Trans. vol. iv.).

"Eels migrate from the salt water, of different sizes; but I believe never, when they are above a foot long, and the great mass of them are only from two and a half to four inches. They feed, grow, and fatten, in fresh water. In small rivers, they are seldom very large; but in large deep lakes they become as thick as a man's arm, or even leg; and all those of a considerable size attempt to return to the sea in October or November. Those that are not of the largest size, pass the winter in the deepest parts of the mud of rivers and lakes, and do not seem to eat much, and remain, I believe, almost torpid. Their increase is certainly not known in any given time, but must depend on the quantity of their food; but it is probable that they do not become of the largest size, from the smallest, in one or even two seasons. As very large eels, after having migrated, never return to the river again, they must (for it cannot be supposed that they all die immediately in the sea) remain in salt water; and there is great probability that they are then confounded with the conger, which is found of different colours and sizes, from the smallest to the largest, from a few ounces to one hundred pounds weight."

I shall conclude this paper with some observations of Mr Jesse, on the hybernation of eels. "That eels hybernate during the cold months there can, I think, be little doubt, few or none being caught at that time. I have endeavoured also, but without success, to procure eels in the winter, from those places in the river Thames where, I have every reason to believe, they go to spawn. I read an account which, if correct, would serve to prove what I have now stated. A boy at Arthurstown, in the county of Wexford, perceived something of a very unusual appearance floundering upon the sand at low water. Upon a nearer approach he found it to be a quart bottle, which showed many symptoms of animation. He seized it, and brought it in. It was found to contain an eel so much thicker than the neck of the bottle, that it must be supposed the eel made its lodgement there, when it was younger, and of course smaller. It was necessary to break the bottle for the purpose of liberating the fish.

"If this account be true, it goes to prove, in a curious way, as far as one instance can do so, the propensity which eels have to hybernate during the cold months. It also seems to prove, that they do this in the tide-way if they can, and that they neither feed nor deposit their spawn till the season of hybernation is over. It is indeed a general opinion among old fishermen that eels cannot bear cold."*

NINTH WEEK—FRIDAY.

NEW-YEAR'S DAY.

It is said to be the custom, in some nations, to mourn at the birth of a child, because of the anticipated evils which it is destined to endure in this vale of tears. This is, doubtless, to form a false estimate of human life, in which, on the average, pleasure far predominates over pain; and surely the contrary custom of rejoicing when another rational and immortal creature is brought into existence, is much more justifiable. But I am not cer-

* Jesse's Gleanings, 3d series, pp. 69, 70.

up her nest, fluttereth over her young, spreadeth abroad her wings, taketh them, beareth them on her wings, so He watches over His rational offspring, delighting to lead, instruct, and bless them: Rising still higher, it reminds us of the tenderness He has infused into the mind of earthly parents, and says, "If you being evil, know how to give good gifts to your children, how much more shall your Father which is in heaven give good things to those who ask him." Nay, it represents the Eternal as condescending to compare his regard for his people, with that of a fond mother for the infant smiling upon her knee, "Can a mother forget her sucking child, that she should not have compassion on the son of her womb? yea, she may forget; yet will not I forget thee." It does much more; it opens up to us the wonders of redeeming love, presenting to our view the Son of the Eternal humbling Himself for our sakes, to assume the form of a servant,—becoming a man of sorrows,—submitting to ignominy, torture, and death; and then it crowns all, by making this unanswerable appeal, "If God spared not his own Son, but delivered him up for us all, how shall he not, with him, also freely give us all things!"

Such is the unspeakable encouragement which the Christian derives from the Gospel of his Divine Master. And shall we not "work out our own salvation, seeing it is God who worketh in us both to will and to do of his good pleasure." In this mighty task, we cannot indeed avoid being affected with "fear and trembling," when we reflect on what we have at stake; but we have also every thing to hope, for He who is for us, is greater than all that can be against us; and the value of the prize which is set before us is inestimable.

NINTH WEEK—SATURDAY.

MIGRATION OF THE LAND-CRAB.

As I do not intend to resume, in any other part of this work, the subject of migration, I shall now notice one other migratory animal, which deserts its usual haunts for the purpose of finding an appropriate spot for depositing its eggs, and whose instinct, in this respect, is peculiarly remarkable. I allude to the land-crab. It is noticed by Kirby, but I shall chiefly follow the account given in "Goldsmith's Animated Nature," which contains most of the particulars known of this extraordinary little animal, and from which the description of it, both in the work already mentioned, and in the Edinburgh Encyclopedia seems to be principally drawn.

The crab is of the same kind with the lobster, which in many particulars it resembles. The residence of the greater part of the species is in the waters; but that which I am now about to present to my readers, is entirely an inhabitant of the land, being found chiefly among the mountainous ranges of the Caribbee Islands; and although it has gills like a fish, it speedily perishes when submerged. There is one occasion, however, and only one, when it seeks the sea-coast, and seems to prove, not only by its form, but by its habits, its affinity to its congeners of the ocean; and that is, when it is about to reproduce its species. It would seem that the eggs of this creature, which bear a remarkable resemblance to the spawn of fish, require to be hatched in the sea. The crab is warned of this by its instinct; and, though its usual residence is in mountainous districts, at a considerable distance from the shore, where it lives on roots and vegetables, and where its habits are exceedingly retired, it undertakes a tedious and perilous jonrney, in obedience to the first law of its nature. The form of this animal is little fitted for travelling. It is thus gu-

phically described by Goldsmith :—" The violet-crab somewhat resembles two hands, cut through the middle, and joined together; for each side looks like four fingers, and the two nippers or claws resemble the thumbs. All the rest of the body is covered with a shell as large as a man's hand, and bunched in the middle, on the fore-part of which there are two long eyes, of the size of a grain of barley, as transparent as crystal, and as hard as horn. A little below these, is the mouth, covered with a sort of barbs, under which there are two broad sharp teeth, as white as snow. They are not placed, as in other animals, cross ways, but in an opposite direction, not much unlike the blades of a pair of scissors. With these teeth they can easily cut leaves, fruits, and rotten wood, which is their usual food. But their principal instrument for cutting and seizing their food, is their nippers, which catch such a hold, that the animal loses the limb sooner than its grasp, and is often seen scampering off, having left its claw still holding fast upon its enemy."

Such is the creature whose extraordinary instinct we are about to describe. Among the mountains they live in a kind of orderly community, usually burrowing in the earth, in the midst of inaccessible retreats. They choose the month of April or May to begin their expedition, and then sally out by thousands from the stumps of hollow trees, from the clefts of the rocks, and from the holes which they dig for themselves under the surface of the ground. The procession sets forward with the regularity of a well-disciplined army. They are commonly divided into three battalions, of which the first consists of the strongest and boldest males, that, like pioneers, march forward to clear the route, and face the greatest dangers. The main body of the army is composed of females, which never leave the mountains till the rain is set in for some time, and these descend in regular array, being formed into columns sometimes of fifty paces broad, and three miles deep, and so close that there is no setting down one's foot, without treading on some of

them. Three or four days after this, the rear-guard follows, a straggling undisciplined tribe, consisting of males and females, neither so robust nor so numerous as the former. The sea being the place of their destination, to that they direct their march, with right-lined precision, turning neither to the right hand nor the left, except compelled by absolute necessity, and attempting even to scale the walls of houses which may be in their way, rather than be diverted from their direct course. " At this season," says Mr Barclay, speaking of what happens in Jamaica, in a paper published in the New Edinburgh Philosophical Journal, " it is impossible to keep them out of the houses, or even out of the bed-rooms, where, at one time scratching with their large claws, and at another rattling across the floor, they make a noise that would not a little astonish and alarm a stranger." The night is their chief time of proceeding; but, if it rains by day, they do not fail to profit by the occasion, continuing to move forward in their slow uniform manner. When the sun shines, and is hot on the surface of the ground, they make a universal halt, and wait till the cool of the evening. When terrified, they move back in a confused disorderly manner, holding up their nippers as a weapon of offence, and clattering them together, as if to threaten with vengeance those who disturb them. It is remarkable, that if any of them get maimed on their journey, and unable to proceed, instead of leaving them to fall a prey to their enemies, their companions fall upon them, and tear them to pieces; and, although not naturally carnivorous animals, they are said to devour them on the spot.

After escaping a thousand dangers in the course of a march, which sometimes occupies three months, they at last arrive at the shore, and prepare to cast their spawn. The eggs are still within their bodies, not being as yet excluded, as is usual in animals of this kind, into a receptacle under their tail. But no sooner does the crab reach the shore, than it eagerly goes to the edge of the

water, and lets the waves wash over its body two or three time. This seems to be a necessary preparation for bringing the spawn to maturity; and, without farther delay, it withdraws to seek a lodging on land. The spawn now grows rapidly larger, is excluded from the body, and sticks to the barbs under the flaps of the tail. This bunch is seen as big as a hen's egg, and exactly resembling the roes of herrings. In this state, the crabs once more seek the shore; and, shaking off the spawn into the water, leave it to be hatched by the united influence of the sea and a tropical sun, and immediately begin their retreat to the mountains, which, however, their exhausted state often prevents them from ever again being able to reach, especially as they are said to moult or cast their shells by the way. It has been stated that whole shoals of hungry fish are, at this time, watching the shore, in expectation of the annual supply which Providence has thus provided for them. However this may be, millions escape the rapacity of these enemies; and, soon after, an immense tribe of little crabs is seen quitting the shore, and slowly travelling up to the mountains. Mr Barclay, in the paper already alluded to, gives a striking description of a migration of these singular animals, which he himself witnessed in Jamaica, but which he seems to consider as altogether unusual in that island, at least to the extent which he details. "On descending Quahill," says this gentleman, "from the vale of Plaintain-garden River, the road appeared of a reddish colour, as if strewed with brick-dust. I dismounted from my horse to examine the cause of so unusual an appearance, and was not a little astonished to find that it was owing to myriads of young *black* crabs,* about the size of the nail of a man's finger, crossing the road, and moving, at a pretty pace, direct for the mountains. I was concerned to think of the destruction I was causing, in travelling through such a body of useful creatures, as I fancied that, every time

* This is the same species as that above described, which is called by Goldsmith the violet crab.

my horse put down a foot, it was the loss of at least ten lives. I rode along the coast, a distance of at least fifteen miles, and found it nearly the same the whole way, only that, in some places, they were more numerous, in others less so. Returning the following day, I found the road still covered with them, the same as the day before."* It is worthy of remark, that this prodigious multitude of young ones, were moving from a rock-bound shore, formed by inaccessible cliffs, the abode of sea-birds, and against which the waves of the sea were constantly dashed by the trade-wind blowing directly upon them. That the old crabs should be able to deposit their eggs in such a part of the coast (if that, as would appear, is the habit of the animal), is not a little extraordinary.

The whole of this well-authenticated history is so full of wonder and instruction, that, did space admit, I should be tempted to express the feelings to which it naturally gives rise; but the conclusions which may be drawn from it, in favour of Creative Intelligence, are too obvious to require comment, and may be safely left to the reflections of the reader. The delicate food which is thus thrown, as if by the immediate hand of Providence, in the way both of the inhabitants of the land and sea, will not escape observation.†

* Mr Barclay expresses the utmost surprise at this phenomenon, which he declares to be altogether unprecedented; but if it be true that the young as well as old crabs, usually burrow through the day, and travel only by night, this may partly account for the appearance not being familiar to the inhabitants. On the present occasion, some peculiar state of the atmosphere may perhaps have led the animal to deviate from its usual instinct.

† Mr Barclay says, that he has seen several thousand crabs caught in one night by the Negroes, for sale or home consumption: and he adds, that they are one of the greatest delicacies in the West Indies.

TENTH WEEK—SUNDAY.

WINTER AN EMBLEM OF DEATH.

The seasons of the year have been aptly compared to the various stages in the life of man. Spring, when Nature bursts into new life, and with such grace spreads out its growing charms, amidst alternate smiles and tears, beautifully shadows forth the period of infancy and youth; summer, with its full-blown beauties, and its vigorous powers, represents the maturity of manhood; autumn, when the golden harvests are reaped, and the fields are stripped of their honours, and exhausted Nature begins to droop, is a striking figure of the finished labours, the grey hairs, and the advancing feebleness of old age; while winter, cold, desolate, and lifeless, indicates, with an accuracy not more remarkable than it is affecting, the rigid features and prostrate energies of the human frame in death.

The close of the year which has just taken place, and the gloom which still continues, seems peculiarly calculated to remind us of human decay. The vital powers which produced and sustained vegetation are withdrawn; the forests are leafless; hill and dale mourn their faded verdure; and cheerless desolation reigns. Recollections of the past, and anticipations of the future, oppress the sensitive mind. Let us turn our thoughts, then, on the congenial subject of death: it is the common lot of every thing that lives. From the microscopic insect to man,—all must die. Each has its spring, its summer, and its autumn;—each, also, has its winter. With some, life is literally but a single day,—or less, a few hours perhaps;—others survive even the period of human existence; but the various stages of life belong to the ephemeron, as well as to the elephant; and the former fulfils the end of its being, as well as the latter; while the hours of the

one are perhaps equally pregnant with incidents, as the years of the other.

Death is gloomy and revolting, if we look only at its externals. Who, that has seen a lifeless corpse, has been able to remain unmoved, by the affecting contrast to its former self, which it exhibited? The closed and sunken eye, which erewhile beamed with intelligence, or sparkled with delight; the motionless lips, which gave utterance to sentiments of wisdom and of piety, or, it may be, of reckless folly and unblushing falsehood; the heart which beat with feeling, and the head which meditated, planned, and formed conclusions, what are they now? A heap of lifeless clay,—a mass of corruption,—food for worms!

But, when we look deeper, and regard death with the eye of reason and religion, it assumes a very different aspect. The body is but the house of the soul. The feeble tenement has fallen into decay, and its living inmate has removed. It is but the covering in which the chrysalis was confined; the time of its change has arrived, and it has burst its shell, to expatiate in a new life; or rather it is the instrument with which an intelligent being performed its work;—the task is finished—the instrument is worn out, and cast away,—the artificer has gone to other labours.

Such is the conclusion of reason; and the analogy of Nature gives countenance to the view. Nothing is annihilated. Every thing, indeed,—organized matter above all, grows old, corrupts, and decays; but it does not cease to exist, it only changes its form. The herbs, the flowers, and the leafy pride of spring and summer, wither, fall, and are mingled with their parent earth; but from their mouldering remains, elements are furnished which clothe a new year with vegetable life, as fresh, and abundant, and lovely as before. Nature is not dead, but sleepeth. The seeds, roots, and buds of the year that are past, are preserved, through the rigours of winter, with admirable care, till the voice of a new spring calls them

once more into life, that the seasons may again run their course, and autumn may again spread her liberal feast. Neither does the soul perish. It has "shuffled off its mortal coil," but it has not ceased to live. This is a conclusion at which we eagerly arrive.

What, then, has become of this ethereal spark? Reason cannot tell; but conjecture has been rife. Some have imagined, that the disembodied spirit passes into other bodies, and runs a new course of birth, life, and death, in new forms,—that all living things, from the lowest to the highest grade, are possessed of souls, which either have animated, or may yet animate, human frames; and that a constant change from species to species, and from individual to individual, is taking place, regulated, in some mysterious way, by the law of retribution. This ingenious fancy, which has been called the doctrine of metempsychosis or transmigration, has been widely disseminated through the extensive regions of the East, and has given a very peculiar mould to the practices, and even to the moral character, of those who receive it.

A prouder and more metaphysical philosophy, which prevails in the same quarter of the world, has offered another solution of the question. All life, it is said by the followers of this sect, is but an emanation from the great fountain of existence,—a drop from the universal ocean of life. Death comes, and the emanation is absorbed,—the drop returns to the ocean, and mingles, undistinguished, with its parent element.

Another doctrine, well known, because associated with all our classical recollections, is that of Greece and Rome; which assigns to souls a separate state of existence in the infernal regions, where rewards and punishments are awarded, according to the good or evil deeds of a present life. The puerile fables, false morality, and fanciful traditions, which are mingled with this doctrine, tend to debase and render contemptible, what might otherwise be considered as the germ of a purer faith.

All that history records, or modern discoveries have

ascertained, of the belief of mankind on this subject of vital importance, tends to show the impotence of human reason; and shuts us up to the revealed word of God, as the only source of light and of hope regarding the future destiny of man. The soul survives the grave, but where does it go? What new forms of being does it assume? What conflicts and what triumphs are reserved for it? These are questions which curiosity, that powerful principle, unites with every selfish and every ennobling feeling of the human heart, to urge on the attention. And what is the answer which the Divine oracles return? Man is a sinner, and "the wages of sin is death." Such is the appalling response. And what is death? Not the separation of the soul from the body merely, but the separation of both soul and body from God for ever.

And is there no remedy? Not in the power of man, but in the grace and mercy of God. "God so loved the world, that he sent his only begotten Son, that whosoever believeth on Him might not perish, but have everlasting life." The incarnate Son of the Eternal God is our Saviour. He came to earth, and assumed our form and nature, that He might take away sin by the sacrifice of Himself. His own words are, "I am the resurrection and the life. Whosoever believeth in me, though he were dead, yet shall he live; and whosoever liveth and believeth in me, shall never die."

Blessed assurance! But does it belong to all? No! It belongs only to believers. All else are excluded. What, then, is the portion of unbelievers? There is only one answer,—"Spiritual death." Their inheritance is, the undying worm, and the unquenchable fire. The offer of life has been freely made, and they have rejected it: It has been urged upon them by every motive, it has been enforced by every sanction, and yet they have rejected it. The means of grace, the warnings and lessons of Providence, in the varied occurrences of life, have all been employed in vain. They have chosen death, and have sealed their own doom.

But to you, who close with the offered redemption, it is not less secure than it is glorious in the means employed, and unspeakably gracious in the blessings bestowed. By the vicarious sufferings of the Son of God, sin is punished, and the sinner absolved; eternal justice is satisfied; and infinite holiness is reconciled. From the horrors of impending destruction, the guilty descendant of Adam is introduced to anticipations of everlasting life; —the child of Satan has become an adopted child of God; —the heir of hell, a joint heir with Christ of the blessedness of heaven.

What, then, is death? It is to the Christian but the passing away of a feverish dream, and an awaking to the glorious realities of an endless and unclouded day. This at least it is, as far as regards his soul. But his body goes down to the grave, and, for all that we can perceive, is finally resolved into its native elements. Yet it is not so. A germ remains. It is like seed buried in winter, by the sower, beneath the sluggish soil, that it may undergo a mysterious change, and rise again to life, in a new season, under a more propitious sky. The spring of an eternal year will come. It will breathe on the dry bones, and they shall live. Then shall the soul be reunited to its material frame, "sown a natural body, but raised a spiritual body;" and this mysterious re-union, which seems essential to the perfect happiness of human beings, will consummate the appointed period, when death, the last enemy, shall be "swallowed up in victory;" when time itself shall perish, along with the revolution of seasons; and when one vast, measureless, incomprehensible eternity, shall embrace all.

TENTH WEEK—MONDAY.

HYBERNATION.—OF QUADRUPEDS—THEIR CLOTHING.

One obvious disadvantage arising from the change of climate from heat to cold, is the effect on the bodily

frame, which, at one season, is oppressed with the fervid rays of an almost vertical sun, and, at another, made to shiver under the biting blast of a wintry sky. It was not consistent with the plans of Providence for this fallen world, that this inconvenience should be altogether compensated for; but the contrivances by which it is alleviated, and rendered tolerable, are truly wonderful. One of the most familiar of these contrivances, is a change from summer to winter clothing.

Man is born naked, but his Creator has endowed him with rational powers, which enable him to procure a dress suited to the various climes in which he is destined to live, and to change it with the changing weather, or his altered residence. The lower animals, not being favoured with the high attribute of reason, have their wants, with respect to clothing, attended to in another way. Those which reside under the burning suns of the tropics, are remarkable for their covering of hair, and the total absence of wool; while animals of the very same species, when resident in colder countries, are found to be clothed with a warmer covering, which becomes still more abundant and woolly as we approach the Polar Regions. The remarkable change, in this respect, which takes place within a very limited distance, and under no very violent change of temperature, may be exemplified by comparing the strong and thin bristles of the Devonshire swine, with the furry coat of those of the Highland breed. As an instance of this beneficent law of Nature, in a more extensive range, we may take the sheep, whose covering, in the tropical regions, is a scanty coat of hair, which, on the alpine ranges of Spain, becomes a fine soft and silky wool; in the mainland of Britain, is changed into a fleece, coarser, indeed, but thicker, and better adapted to resist the vicissitudes of our changeable weather; in the Shetland Islands, undergoes another transformation, still more capable of resisting the cold; and, in Iceland, and other regions verging towards the Pole, acquires the character of a thick fur, interspersed with

long and coarse hair,—a provision which is common to the clothing of numerous northern tribes, and which seems admirably calculated at once to foster the animal heat, to give free passage to the insensible perspiration, and to serve as a protection from the penetrating rains.*

Now, what we wish the reader particularly to remark is, that effects similar to those which are produced on the clothing of animals by a change of climate, are, to a certain extent, produced also by the different seasons of the year. There is a beneficent adaptation, in this respect, to the alternations of heat and cold, in the same country. Examples of this wise provision, among our domestic animals, are familiar to every farmer. The horse, the cow, and the sheep, when exposed to the open air, all acquire a rough coat in winter, which they throw off as the warm weather advances, being then supplied with a thinner and sleeker covering; and, what is remarkable, the shagginess, and consequent heat, of their clothing is proportioned, in each species, to the extent of their exposure, and the intensity of the cold. So much is this the case, that it has been alleged, probably, however, with some degree of exaggeration, that, "if we were to look at the horses, for example, of the farmers on a market-day in winter, we might determine the relative temperature of their respective farms, from the relative quantity of clothing provided by Nature for the animals which live on them."† The dealers in fur are well acquainted with the change we are now considering. In summer, the fur of those animals which are valued for the possession of this article of commerce, is too thin and short to be an object of pursuit; but, as soon as the frost and snow begin to show themselves, a rapid alteration takes place, and the fur is then said to have suddenly *ripened*. This is remarkably the case in the hare and rabbit.

* See Kirby's Bridgewater Treatise, vol. i. p. 64. See also Scripture Geology, p. 349.

† Edinburgh Encyclopedia—article Hybernation.

Another beneficent provision of the Creator, for alleviating the effects of cold in winter, is to be discovered in the change of colour, which takes place in the clothing of some species, both of quadrupeds and birds. It is remarkable, that the tendency of this change is from dark to pure white. Thus the ermine, which is in the summer months of a pale brown colour, inclining to red, is highly prized in winter for the snow-like whiteness of its fur; and the Alpine hare of the Grampian range undergoes a similar change, throwing off its summer dress of tawny grey, and appearing in a coat of the colour of milk. Among the feathered tribes, we find the ptarmigan, which takes up its habitation on the summits of our most lofty Highland mountains, and the guillemot, which frequents our coasts, endowed with an analogous property. In the former, the change is complete; in the case of the latter, its summer covering of black, is, in this climate, converted into a plumage clouded with ash-coloured spots, on a white ground; but, what distinctly marks the intention of the Creator, is, that this latter bird, when exposed, as in Greenland, to a more intense cold, throws off its spotted mantle, and appears in feathers of a beautiful and uniform white.

The object of this remarkable change in the appearance of these animals, is not merely, as some writers have supposed, to protect them from the prying eyes of their enemies, by assimilating their colour to that of the snow, though this intention is not to be overlooked; but chiefly, as I believe, to provide more effectually for their protection from the alteration in the temperature of the seasons. It might, perhaps, on a superficial view, appear, that white, which consists in the reflection of all the rays of light, was less favourable than any other colour to the heat of the body, and that, were the intention to protect the animals from cold, the process would just be reversed. It is true, indeed, that a dark surface imbibes the heat to which it is exposed in greater quantities than that which is of a light hue, and if this were

all that was required, the objection might be held to be well founded. But it must be remembered, that the temperature of a living body depends chiefly on the power of retaining the animal heat; and it is on this principle that we are to look for the ultimate design in the change of colour to which we have alluded. It would appear, from chemical experiment, that the radiating power of bodies is inversely as their reflecting power; and, upon this principle, the white colour of animals, possessing less radiating power than any other, must be best calculated to retain the heat generated in their bodies by the vital principle. Thus, while there is less warmth absorbed from the external atmosphere than if their darker colour had remained, this disadvantage is far more than compensated by the power which their white clothing confers, of resisting the effects of the external cold in reducing the temperature. This is one of the cases which we so commonly meet with in investigations of a similar kind, where an imperfect knowledge of the laws of nature affords room for plausible objections against the arrangements of Providence, which a more profound acquaintance with these laws entirely overturns, and even converts into an argument on the opposite side. Had we only known, that a white colour rejects the influence of external heat more obstinately than all the other colours, we might well be puzzled to account for the fact, that during the winter months a change should take place, which was to render the bodies of the animals subject to it, less susceptible of atmospherical warmth, in proportion as they seemed most to require this blessing; but, when the more recent discoveries, which prove that the principle of radiation follows an opposite law, set the matter in its true light, it is impossible not to feel that peculiar satisfaction which arises from perceiving the consistency of benevolent design; and the lesson which we are thus taught goes even farther, leading us, as it does, confidently to conclude, that wherever facts apparently contradictory of Divine wisdom or goodness are to be found, the difficulty lies, not in the nature of the thing, but in the darkness of human ignorance.

TENTH WEEK—TUESDAY.

HYBERNATION.—STORING INSTINCTS.

As birds have the power, and are endowed, when necessary, with the instinct of migration, they scarcely stand in need of any other means of avoiding the inconveniences of winter; and, accordingly, we find, that except the change already mentioned, of a summer for a winter dress, which takes place in some species, and the autumnal repairing of their feathers, there is no other provision of great importance and extent made for their hybernation. But with quadrupeds, reptiles, and insects, the case is different. As they were destined to be confined to a limited locality, it was necessary to make sufficient arrangements for their accommodation within their native haunts. The warm clothing, which, as we have seen, quadrupeds acquire, is calculated to preserve them from the effects of cold; but something more is necessary. Not only is the breath of winter chilling, but its hand is niggardly of food; and there is danger of starvation, not less from the cravings of hunger than from the rigour of the weather. To this want the beneficent Creator has not been inattentive; and the means he employs to remedy the evil are not less remarkable than they are efficacious.

There are two ways in which a deficiency in the supply of the necessaries of life may be compensated for, namely, either by the accumulation of a store of provisions during the period of plenty, or by placing the body in such a state as to supersede the use of such accumulation, by rendering it insensible to the demands of hunger, and yet preserving its vital existence. The Creator

employs both of these means. This paper shall be devoted to the consideration of the former.

The class of quadrupeds, among which various species are to be found, that lay up a winter store, is exclusively what is known to naturalists by the appellation of *glires*, or gnawing animals. Of this class are the mouse, the squirrel, and the beaver. Of the first species, the field-mouse is the most remarkable for this propensity. This little animal is exceedingly active about the end of autumn in preserving fallen acorns, by burying them under ground; being thus made subservient to the double purpose of hoarding a store for future use, and of planting such part of the seed as it either forgets or does not require, in such a manner that it may germinate and spring up into a future tree,* destined to provide the means of subsistence to distant generations of the species. Such is the wonderful economy of Providence; and this, let it be remarked, in passing, is only one instance of a kind of contrivance extensively employed, which we shall afterwards have occasion to notice.

We have mentioned the common squirrel as another example of the storing tribe. This agile and interesting creature takes up its residence in our woods and forests, and, during the last month of autumn, is exceedingly industrious in collecting for itself a hoard of nuts, acorns, and other kinds of food, which it carefully deposits in a storehouse, scooped out with some labour, in a well-chosen place of concealment, among the large and embowering branches of a shaggy old tree. Here it takes up its winter abode, prudently abstaining from the violation of its little magazine, as long as it can find the means of subsistence in its neighbourhood.

But of all the quadrupeds which provide for their preservation during winter, by laying up a stock of food, there are none so wonderful as the beavers. A branch of this amphibious family was at one time to be found in Britain; and beavers are still natives of some northern countries in Europe, though their chief residence is in the wilds of America. They have long attracted the admiration of mankind by their extraordinary habits. Some of our most celebrated naturalists, indeed, fired by the exaggerated accounts of travellers, have launched out into encomiums on their wonderful faculties, which a more accurate knowledge of their operations has of late considerably modified. After every allowance, however, for the natural propensity of men to add astonishment to the wonderful, we find enough in the most sober and authentic accounts given of this quadruped, to excite our surprise.

The form of the beaver does not appear to be peculiarly well fitted for performing works of skill and labour. It is described as not exceeding three feet in length; its paws are said to be about the size of a crown piece; and its tail, though, by its breadth and flatness, answering some important purposes, seems to be limited in power as an instrument of labour, by having naturally such an inclination downward, that it can with difficulty be brought on a line with its back. Yet this apparently weak and ill-furnished creature, is represented as supplying, by its ingenuity, the seeming defects in its bodily form, and constructing works for the comfort and convenience of its winter residence, which, in reference to its more contracted wants, rival the skill and science of a human architect! The following notice of the manner in which these animals provide against the inclemency of the winter season, is abridged from a judicious article in the Edinburgh Encyclopedia.

"Towards autumn, they quit their roving way of life, form themselves into communities, and, instructed by that admirable instinct of which we have so many examples in the history of the animal creation, begin to

* "In the time of acorns falling," says Derham, "I have, by means of the hogs, discovered that the mice had, all over the neighbouring fields, treasured up single acorns in little holes they had scratched, and in which they had carefully covered up the acorn. These the hogs would, day after day, hunt out by the smell."—*Derham's Physico-Theology.*

provide for the wants of a season, whose duration and inclemency would effectually preclude a regular supply of their accustomed nourishment.

"The winter quarters of the beavers are situated on the banks of a river or creek, or, where these are not to be found, on the edge of a lake or pond. In selecting the exact spot where they may form their houses, they appear to be guided by two considerations, viz.—a sufficient depth of water, to prevent its being completely frozen; and the existence of a current, by means of which they can readily convey wood and bark to their habitations. To prevent the water from being drained off, when the frost has stopped the current towards its source, the beavers construct a dam across the stream; and, in this work, they certainly display wonderful sagacity, skill, and perseverance. The dam is constructed of drift-wood, branches of willows, birch, poplar, stones, and mud, brought by the beavers in their mouths, or between their paws, and not, as many have asserted, on their tails. If the current be slow, the dam runs straight across; but if the stream be rapid, the dam is formed with a regular curve, having the convexity towards the current, so as effectually to resist the force of the water and ice, that rush down during the storms of winter, or the thaws that take place in spring. These dams are several feet in thickness, and of such strength, when completely formed, that a man can walk along them with perfect safety.

Having completed their dam, they proceed to construct their cabins. These are partly excavations in the ground, though their roofs form a sort of vaulted dome that rises a little above the surface. The houses have seldom more than one apartment, and never more than one floor, which is raised in the middle, to allow of the inhabitants eating and sleeping in a dry situation. The principal entrance and outlet to these houses, is next the water, on the very edge of which they are constructed; and the opening always slopes towards the water, till it

terminates so far below its surface, as to preserve a free communication in the most severe frosts. There appears to be another, though smaller, opening next the land. The houses are of various sizes, in proportion to the number of inhabitants, which seldom exceeds ten or twelve, though sometimes double that number has been found in the same dwelling. Many of these houses stand together along the margin of the water, forming a village of from ten to thirty tenements.

"During the latter end of summer, the beavers cut down their wood and collect their roots. The latter are kept in the water, whence they fetch them as occasion may require. In eating, they sit on their rump like a squirrel, with their tail doubled in between their hind legs, and holding their food between their paws. When disturbed, they utter a peculiar cry, and plunge into the water, flapping the ground and the water with their tail."

The faculty of storing is also to be found, as we have previously stated, among insects, of which the example of the honey-bee is the most striking. The habits of this wonderful insect, the large and orderly community in which it lives, yielding undeviating fealty to a female sovereign; the mathematical precision with which it builds its cell; its unwearying industry; its wise foresight; its colonizing propensity,—have already been described in speaking of the hybernating instincts of the insect creation. In studying its operations, as well as that of the beaver, and indeed of the other storing animals, we seem to get still deeper insight into the nature of that mysterious faculty which, resembling reason in so many particulars, yet differs from it in this, that its impulses are uniform and unchangeable, belonging nearly in equal perfection in all ages, and under all circumstances, to every individual of the species; not capable of improvement by education, but regulated by propensities directed by a wisdom of which the species is not conscious, to the attainment of a future object, which

they have not forethought to contemplate.* What is this but the impress of the finger of God?

TENTH WEEK—WEDNESDAY.

HYBERNATION.—TORPIDITY OF ANIMALS.

Among the contrivances by which the Author of Nature enables the lower animals to sustain the privations of winter, that by which they are endowed with the faculty of becoming insensible to external objects, and of approaching a state of temporary death, is very worthy of attention. The ordinary phenomena of sleep have long been a subject of deep curiosity to the philosophical inquirer. The torpidity of animals during the cold sea-

* Mr Broderip gives a curious and interesting account of the habits of a tame beaver, brought to this country in 1825, which seems to illustrate the distinctive difference subsisting between reason and instinct, even where they appear to make the nearest approach. This little creature was still very young when let out of his cage, but immediately showed his building instinct. He began by selecting the longest materials within his reach, such as sticks, sweeping-brushes, &c., which he piled up in such a way that one end touched the wall, and the other projected into the room. "As the work grew high, he supported himself upon his tail, which propped him up admirably; and he would often, after laying on one of his building materials, sit up over against it, apparently to consider his work, or, as the country people say, 'judge it.' This pause was sometimes followed by changing the position of the material 'judged,' and sometimes it was left in its place. After he had piled up his materials in one part of the room (for he generally chose the same place), he proceeded to wall up the space between the feet of a chest of drawers which stood at a little distance from it, high enough on its legs to make the bottom a roof for him, using, for this purpose, dried turf and sticks, which he laid very even, and filling up the interstices with bits of coal, hay, cloth, or any thing he could pick up. This last place he seemed to appropriate for his dwelling; the former work seemed to be intended for a *dam*. When he had walled up the space between the feet of a chest of drawers, he proceeded to carry in sticks, cloth, hay, cotton, and to make a nest; and, when he had done, he would sit up under the drawers, and comb himself with the nails of his hind feet."

It is scarcely necessary to say, that there was, in the case of this tame beaver, a propensity evinced to construct, where the object of the propensity no longer existed. The Author of its being had bestowed on it this instinct, for the use of the species in its wild state; and, being destitute of the reasoning power which would have taught it the needlessness of the trouble it was taking, it still continued not only to build its house, and line its nest, where it was already sheltered and comfortable, but to construct a dam where there was no water.

son, in some respects, resembles this state; but there is a marked difference not only in the period of insensibility, and in the wise intentions of Providence which it fulfils, but also in the nature of this provision, as it affects the bodily frame, as well as in other particulars.

The subject of torpidity has given rise to several ingenious experiments, by which some curious facts have been elicited. It is not our object to record these, but merely to give a succinct view of their results, in so far as they throw light on the operations of that Divine Being, from whose wisdom and goodness they derive their origin.

The classes of animals, among whom this kind of hybernating principle is found, are very various, viz. quadrupeds, reptiles, insects, perhaps fishes, and, according to some, even birds. Among quadrupeds, the species which are known to become torpid, belong exclusively to the digitated order. A few of these species are of the class *primates*, such as the bat; and of the class *feræ*, such as the hedgehog; but the most numerous instances occur among the *glires*, of which the dormouse and the marmot are familiar examples.

Attempts have been made, but without much success, to ascertain the causes on which torpidity depends. It is not extreme cold, as many have maintained, for some animals collect in deep caves, where the temperature is never low, or congregate and burrow in the earth, where the heat of their bodies preserves a temperature not much inferior to that of the average state of the external atmosphere; and others become lethargic even in warm climates. It is not the position which the body assumes, when about to become torpid, though this has also been alleged; for the different species seem to assume no other position than that to which they are accustomed in ordinary rest; it is not, so far as has been ascertained, any distinct and uniform state of the anatomical conformation, for anatomists have, in vain, attempted to establish any peculiarity in the bodily struc-

ture of such animals, which can account for the phenomenon; it is not, in fine, an immediate destitution of food, for a remarkable fact connected with this state is, that when animals become torpid, they are, generally speaking, unusually plump and fat. Some of these circumstances, indeed, commonly occur at the period when these animals fall into the dormant state, and seem, in a certain degree, to influence the result. Thus, the exact time of the change may be hastened or retarded, by the temperature of the atmosphere, or the plenty or scarcity of food; but there seems to be no reason to conclude, that these circumstances, considered merely as physical causes, are sufficient to account for the phenomenon; and we are rather inclined to believe, that the animals themselves have some power in their own volition, of either inducing or resisting the lethargic condition. Spalanzani has seen bats in a torpid state, even during summer. A migratory hamster (*cricetus glis*), was placed by Mangili in a state of confinement, in spring, when it was naturally in its waking period; and, as soon as it found that it could not escape, it refused to eat, and, throwing itself on its back, became torpid, in which state it remained till the 17th July. The land-testacea certainly have the power of becoming torpid, independent of the severity of the weather. If specimens of the *helix hortensis*, for example, be placed, even at midsummer, in a box without food, they soon attach themselves to the side of the place of their confinement, and become dormant; in which state they may be kept for several years.

Torpidity, in short, is an instinct, and exhibits many of the interesting but mysterious characteristics of this faculty. When the season of storms and scarcity is about to arrive, the animals to whom this habit belongs, carefully select a proper place of retreat, respectively corresponding to their several natures, where they may spend, in a happy oblivion, the dreary winter months. "The bat," to borrow the words of the article "Hyberna-

tion," in the Edinburgh Encyclopedia, "retires to the roof of gloomy caves, or to the old chimneys of uninhabited castles; the hedgehog wraps itself up in those leaves of which it composes its nest, and remains at the bottom of the hedge, or under covert of the furze which screened it during summer, from the scorching sun or the passing storm; the marmot and the hamster retire to their subterranean retreats, and when they feel the first approach of the torpid state, shut the passages to their habitations in such a manner, that it is more easy to dig up the earth any where else, than in the parts which they have thus fortified." "Many of those animals, particularly such as belong to the great natural family of *gnawers*, make provision in their retreats during the harvest month. The marmot, it is true, lays up no stock of provisions; but the hamsters fill their stores with all kinds of grain, on which they are supposed to feed until the cold becomes sufficiently intense to induce torpidity. The *cricetus glis*, or migratory hamster of Pallas, also lays up a stock of provisions. The same remark is equally applicable to the dormouse."

Animals, in preparing for this dormant state, are considerably actuated by their usual habits while awake, not only in the choice of a place of retreat, but also with regard to their social or solitary habits. Thus, the hedgehog and dormouse spend their period of insensibility alone, while the marmot, the hamster, and the bat, collect, for this purpose, in large societies.

Some curious particulars have been noted of the physical condition of animals during their torpidity, which it seems unnecessary to do more than barely to enumerate. In this state they suffer a great diminution of bodily temperature; they breathe slowly, and only at intervals proportioned to the depth of their slumber, sometimes with long periods of total intermission; the circulation of their blood becomes languid to such an extent, that even the pulsation of the heart is scarcely felt; the animal irritability decreases, so that limbs may be lopped

off, and even the vital parts laid open, almost without exciting any symptoms of feeling; the action of the digestive organs is suspended; the body becomes gradually emaciated, and its weight is diminished, but without impairing the living principle, which, on the contrary, is found to be in a remarkably energetic and active state at the period of resuscitation.

Many of the observations which we have made as to quadrupeds, will apply also to reptiles. These cold-blooded animals adopt similar precautions in selecting proper places of retreat, to protect them from their enemies, and to preserve them from sudden alternations of temperature. Those, which inhabit the waters, sink into the soft mud; while such as live on land, enter the holes and crevices of rocks, or other places, where there is little change of temperature. Thus disposed of, they obey the impulse, and become torpid. The effect of cold in inducing and prolonging this state, is much more remarkable than in warm-blooded animals. It is said that frogs and snakes may be kept in a torpid state, in an ice-house, for several years, without any diminution of their vital energy. It is, perhaps, on a similar principle, that toads have been found alive, after having, for centuries, been embedded in the heart of stones.

The torpidity of the *mollusca* tribes, and of insects, is much more general than that of the higher genera of animals; but as the state of these more minute animals during winter has occupied our attention in other papers, I shall at present pass the subject with this single observation, that the paternal care of the Creator is not less conspicuous in the case of the microscopic insect, than that of the most lordly quadruped; and that the lower we descend in the scale of existence, the more striking appear to be the proofs of a universal Providence, which has caused the world to teem with life and enjoyment.

If we cannot, from physical causes, account for the torpidity of animals, neither shall we be able to discover,

in such causes, any adequate reason for their revival at the fit period. This revival does not take place in all classes at the same time; but, speaking generally, none of them burst their lethargic chains till the revolving season has brought round a genial warmth, along with supplies of proper nourishment. Had we only to account for the reviviscence of those animals which are exposed to the changes of temperature, we might, perhaps, rest satisfied with the idea, that the return of warmth was the immediate stimulus by which the change was effected; but what shall we say of the numerous instances in which these winter sleepers bury themselves so deep, or lie congregated so close, and secured so carefully, as to remain beyond the reach of atmospheric changes? By what calendar do the bats, for example, in the interminable windings and dark recesses of the Mammoth cave of Kentucky, count the return of the months of spring? What voice whispers to the little marmot, as it lies in its deep burrow, fostered by the animal heat of its fellows, with every avenue to the open air effectually sealed up, that the stiffening frost no longer enchains the soil, and that the season of herbs and of roots has returned? Only one answer can be returned; and we are forced anew to acknowledge the presence of a mysterious instinct, or rather of that bountiful Being who, while He every where works, every where conceals Himself from mortal eyes; or is seen only by reflection from his visible creation.

We mean not to assert, either here or elsewhere, that, in the processes of instinct, the Creator does not act, as he acts in the better known operations of nature, by means of second causes, which might be made manifest to rational creatures, and the force and adequacy of which might be understood by them; but we do mean to say, that these causes have not yet been discovered; and that, whether discovered or not, there is, in the appearances we have been considering, a distinct and undeniable indication of a Supreme Intelligence moulding

the faculties of living creatures, and wonderfully adapting their powers to the circumstances of the external creation, so as to promote the preservation of their existence, and to contribute to their enjoyment.

TENTH WEEK—THURSDAY.

1. MAN IN WINTER.—PRIVATION STIMULATES HIS FACULTIES.

THERE is something very peculiar, but remarkably adapted to the general constitution of nature, in the circumstances and condition of man, as compared with other animals, pointing directly to certain great ends and principles of his existence, and confirming, in a very striking manner, the character which we have already stated to be impressed by the great Creator on his works. Man is, of all animals, the least provided with natural means of defence from his numerous enemies, as far as relates to his bodily powers, and the most scantily supplied with protection from the vicissitudes of climate. He enters life unclothed, and utterly helpless; he grows up slowly to manhood, amidst a thousand difficulties and dangers. During the first period of his existence, he must necessarily depend on the good offices of others for the means of preserving life; and in the last stage he descends again into all the feebleness, inactivity, and dependance, of a second childhood. It is not so with other animals. They come into the world clothed, armed, and furnished with instruments and means of subsistence, or, at least, after a few days or weeks of dependance on their parents, they are thrown upon their own resources, with ample means of support and enjoyment. This contrast between the early condition of man and the lower animals, is described by a Roman poet in lines elegant, but querulous, which may be thus translated :—

> The infant, first emerging into day,
> Amidst a mother's agonizing throes,
> Lies, like the shipwreck'd mariner, when toss'd
> From the fierce billows,—naked, helpless, sad ;
> And weeps and moans, as well beseems a wretch
> Cast on a world with grief and pain oppressed.
> Not so the peaceful flocks and herds are rear'd,
> Not so the savage beasts ;—for naught want they
> Of cradled rest, or bland and prattling talk
> Of watchful nurse, or clothing warm or cool,
> As varying seasons rule the inconstant year.
> No arms they seek, nor lofty walls, to guard
> Their hoarded treasures ; for, with bounteous hand,
> Earth spreads her varied stores, and Nature yields
> Her wond'rous powers, to bless their countless tribes.*

The intention of the Creator in thus throwing the infant on the immediate protection and tender assiduities of his parents, is not unkind, but the very reverse. Constituted as man is, such a state of dependance on the one hand, and of guardianship on the other, is of the highest importance to the development of the moral and even of the intellectual faculties, and impresses a character of affection and of mutual sympathy on the human heart, which extends from the family circle to the whole relations of life; and while it binds society together by the strongest ties, sheds over it the most endearing charm.

But it is not in this view that we are led at present to consider the subject. We have to inquire how this

* " Tum porro puer, ut sævis projectus ab undis
Navita, nudus humi jacet, infans, indigus omni
Vitali auxilio, cum primum in luminis oras
Nixibus, ex alvo matris natura profudit ;
Vagituque locum lugubri complet, ut æquum est,
Cui tantum in vita restet transire malorum.
At variæ crescunt Pecudes, Armenta, Feræque ;
Nec crepitacula eis opu' sunt, nec cui quam adhibenda est
Almæ nutricis blanda atque infracta loquela :
Nec varias quærunt vesteis, pro tempore cœli.
Denique non armis opus est, non mœnibus altis,
Queis sua tutentur, quando omnibus omnia large
Tellus ipsa parit, naturaque dædala rerum."

naked and houseless creature finds shelter and protection from the rigours of winter; and this throws us into a wide but most interesting field of inquiry, leading, as it does, to a consideration of the peculiar provisions and adaptations by which the energies of the human mind are called forth and disciplined,—a subject to which we formerly adverted, but which seems worthy of reconsideration, as applicable to this particular case.

The sentence which has passed on fallen man is, "In the sweat of thy face shalt thou eat bread, till thou return unto the ground;" and, by the peculiar ordinance of a wonder-working Providence, that which is his curse is converted into the means of giving vigour and enlargement to his mental powers. It is by the pressure of necessity, and the urgency of want, that our natural aversion to labour and love of inaction are overcome. To prove this, we do not need to revert to the theories of philosophers, or to follow man through his fancied stages of advancement, from his lowest grade,—a savage roamer of the forest, feeding on nuts and roots,—till we find him, first a hunter and fisher, then a shepherd, next a tiller of the soil, and, last of all, a man of commerce, and an adept in the arts and sciences.

In the supposed steps of this progress, history does not bear us out; but we do know, from all history, as well as from daily experience, that the wants of man stimulate his ingenuity; that these wants increase with the power of gratifying them, while the ingenuity which supplies them keeps pace with his enlarging desires, and that thus there is a constant action and re-action, which, by a most wonderful and interesting process, urges man on from stage to stage of improvement, till he becomes, what we find him to be in the most advanced state of society,—a being as different, in his mental attainments, from the wandering savage, as the lordly elephant, in his physical powers, is from the blind worm of the earth. The human mind is mighty and various in its facilities; but before these become available to any great extent,

they must be excited by external objects, trained and moulded by discipline, and enlightened by the accumulated wisdom of ages; and to perform these important functions, the circumstances and condition of external nature are admirably suited.

This observation applies universally, and might be illustrated in a thousand different ways; but take the case immediately before us,—the necessity of protection from the vicissitudes of the seasons. In what state do we find civilized man? Think of the comforts and conveniences which he has accumulated around him, for the purpose in view. This naturally naked and helpless creature, makes the whole creation, both animate and inanimate, contribute to his defence from the wintry blast, and from the summer's heat. The hemp, the flax, the cotton plant, and the inner bark of various trees, yield their vegetable stores; the sheep gives its fleece; the silk-worm its web; the cow her hide; the goose and the eider-duck their down; the beaver, the ermine, and the bear, their fur, that his want of natural clothing may be supplied; and that, by adapting his covering to the climate, he may either brave the rigours of a polar sky, or support, without material inconvenience, the fierce rays of a tropical sun.

Again, attend to his place of residence.—What conveniences!—what comforts!—what luxuries! Within his own limited locality, Providence has given him every thing necessary for the supply of his wants. Every where there is to be found stone, and lime, and wood, and iron, or some useful substitutes. Of these, the cottage, the hall, and the palace, are all equally constructed. There is, elaborated by his industry from materials readily within his reach, glass, to admit the light and exclude the chilly blast; there are coals, or billets, or peat, for fire to warm; there are downy beds for necessary rest; and, if ambition or voluptuousness looks farther, the East brings its perfumes and its gems; the West and the South their precious metals and their orna-

mental furniture; the North its oil, to afford artificial day; all climates and all countries contribute, of their abundance and their varieties, to supply the cravings of a constantly increasing and never satisfied appetite for accumulation and enjoyment.

And so it is, that the very privations and disadvantages, with which man comes into the world, become the means by which the desire of acquiring and improving is stimulated, till he not only equals the lower animals in those gifts, naturally withheld from him, with which Providence had endowed them, but rises far beyond them; and, by means of his mental qualities, deservedly earns for himself the title, which his bodily faculties could never have merited, of being emphatically lord of this nether sphere.

TENTH WEEK—FRIDAY.

II. MAN IN WINTER.—PROVISIONS FOR HIS COMFORT.

It is most interesting to look into the various features of that providential administration, by which, under a very peculiar and surprising discipline, the progress of society is advanced, and man rises in the scale of moral and intelligent beings. In the wants of his natural state, as regards the season of winter, we yesterday saw how a stimulus is employed, which, combined, doubtless, with other incentives, induces him to seek, first, necessaries, then conveniences, then comforts and luxuries, till he draws around him the resources of the world, and, by the ever-expanding views of an aspiring mind, calls progressively into action those mental powers, both in himself and his fellows, which might otherwise have lain dormant.

If, from this view of the exercise given to genius and

talent, in counteracting the privations of winter, we turn to the provisions which have been bountifully made, in external nature, for affording scope to these faculties, we shall find additional cause of devout admiration.

The first thing worthy of remark, in this department of the subject, is, that, speaking generally, the materials by which exposure to the inclemency of the season may be obviated, lie patent and abundant in those climates where such inconveniences are liable to be felt. In proportion as we penetrate into the colder regions, animals are found in greater plenty, whose coats of soft and downy fur, furnished beneficently by their Creator for their own protection, when transferred to the human body, defy the wintry storms. If we approach still nearer the polar circle, we discover a provision which renders even these regions of gloom and intense cold, habitable during the severest part of the year. The enormous tenants of the icy seas, which surround these inhospitable coasts, not only furnish the inhabitants with food; but, being enveloped in immense loads of fat, yield to them all that is needful, both for light and heat, in their dark and chilly winter months. Nay, the very snow, which clothes Nature as in a winding-sheet, and seems to augur nothing but desolation and death, is converted, by the ingenuity of man, into a comfortable habitation, and thus becomes a preserver of life, and a means of enjoyment.

Then, again, if we speak of fuel, how bountiful is Providence in supplying those exhaustless forests of pine in the northern regions of Europe, and those immense fields of coal in Britain, and other similar climates, by which frost is charmed away from the dwellings of the inhabitants! Can we believe it to be without a beneficent design, that such amazing magazines of combustible matter should be deposited within our temperate zones? And does it not add to the wonder of this provision, that coal is known to be a vegetable production of a climate altogether different from that in which it is found,—a

climate probably not inferior in warmth, and in the power of nourishing vegetation, to the most favoured of our tropical regions?* When, and under what circumstances, did that profusion of gigantic trees and plants cover the face of the earth, and luxuriate in the sunshine and the shower of a blessed climate, which, under the name of Surturbrand, has erected the platform on which northern Iceland rears its burning mountain, and spreads its rugged hills and plains; and in Britain, the land of manufactures, and America, that new country, buoyant with youthful enterprise, has laid up those amazing stores of fuel, which many centuries of human toil and industry, can scarcely be said to diminish? A mystery hangs over the subject, which the geologist, with all his zeal and acuteness, shall probably in vain attempt to penetrate; but it is enough for our present purpose to know the fact. By whatever natural catastrophe these ancient woods and forests were submerged, there they are, collected in the most convenient localities, at once for furnishing the means of comfort during the rigours of an ungenial winter, and for affording facilities to the increase of human power, in the cultivation and improvement of the arts of life.† Is it too much to say, that here is the hand of a Paternal Providence?

* The high temperature of the localities in which the vegetation was produced that has given rise to our coal fields, is inferred from the gigantic size of the ferns, mosses, and other plants, still discovered in the formation.

† Dr Buckland, after stating that iron is frequently associated with coal in the subordinate beds of the transition series, concludes a chapter on this subject, with the following interesting observations:—"The important uses of coal and iron in administering to the supply of our daily wants, give to every individual amongst us, in almost every moment of our lives, a personal concern, of which but few are conscious, in the geological events of these very distant eras. We are all brought into immediate connexion with the vegetation which clothed the ancient earth, before one-half of its actual surface had yet been formed. The trees of the primeval forests have not, like modern trees, undergone decay, yielding back their elements to the soil and atmosphere, by which they have been nourished, but, treasured up in subterranean storehouses, have been transformed into enduring beds of coal, which, in these later ages, have become to man the sources of heat, and light, and wealth. My fire now burns with fuel, and my lamp is shining with the light of gas, derived from coal that has been buried for countless ages in the deep and dark recesses of the earth. We prepare our food, and maintain our forges and furnaces and the power of our steam-engines with the remains of plants of ancient forms and extinct species, which were swept from the earth ere the formation of the transition strata was completed. Our instruments of cutlery, the tools of our mechanics, and the countless machines which we construct, by the infinitely varied applications of iron, are derived from ore, for the most part coeval with, or more ancient than the fuel, by the aid of which we reduce it to its metallic state, and apply it to innumerable uses in the economy of human life. Thus from the wreck of forests which waved upon the surface of the primeval lands, and from ferruginous mud that was lodged at the bottom of the primeval waters, we derive our chief supplies of coal and iron, those two fundamental elements of art and industry which contribute, more than any other mineral production of the earth, to increase the riches, and multiply the comforts, and ameliorate the condition of mankind."—*Buckland's B. T.* vol. i. pp. 66, 67.

Fuel implies the use of fire, and this leads us to look at some of the properties of that wonderful element, which, on the hearth and in the lamp, contributes so materially to the comforts of winter. This is the very same element, which, by its subtle and all-pervading powers, gives light and warmth to the world, and the effects of which, the poet of the Seasons so beautifully describes, in speaking of the adorable power and goodness of the Creator, when he says, that His mighty hand

> "Works in the secret deep; shoots, steaming, thence
> The fair profusion that o'erspreads the spring,
> Flings from the sun direct the flaming day;
> Feeds every creature; hurls the tempest forth;
> And, as on earth the grateful change revolves,
> With transport touches all the springs of life."

In the treatise on Heat, published in the "Library of Useful Knowledge," there are the following introductory observations, which describe, in a popular manner, some of the most obvious effects of this remarkable agent:—"In all our excursions over the surface of the globe, innumerable objects excite our admiration, and contribute to our delight. But whether our gratitude is awakened by the verdure of the earth, the lustre of the waters, or the freshness of the air, it is to the beneficial agency of heat (under Providence) that we are indebted for them all. Without the presence and effects of heat, the earth

would be an impenetrable rock, incapable of supporting animal or vegetable life; the waters would be for ever deprived of their fluidity and motion, and the air of its elasticity and its utility together.

"Heat animates, invigorates, and beautifies all Nature. Its influence is absolutely necessary, to enable plants to grow, put forth their flowers, and perfect their fruits. It is closely connected with the powers of life, since animated beings lose their vitality when heat is withdrawn. Such is the universal influence of this powerful agent in the kingdoms of Nature; nor is this influence diminished in the provinces of art. It is with the aid of heat that rocks are rent, and the hidden treasures of the earth obtained. Matter is modified ten thousand ways by its agency, and rendered subservient to the uses of man, furnishing him with useful and appropriate instruments, warm and ornamental clothing, wholesome and delicious food, needful and effectual shelter."

Heat is the principle of *fire*, under whatever modification it may appear; and nothing can be more worthy of admiration, than the fact, that an element of such tremendous power, whose operations are on so vast a scale, and whose mastery is so fearful, should yet be capable of being subjected to the service of man, in the most menial offices, and, in that capacity, should become so mild and tractable. What human mind, in the wildest flights of its fancy, could, previous to experience, have conceived the existence of an agent, which appals nature with its angry roar, and, rending the clouds, darts in livid bolts from heaven to earth, or uprears mountains in its throes, and, opening the solid crust of the globe, overwhelms whole regions with torrents of melted rock, poured forth like water; or, more amazing still, which displays its might and glory, in shedding the effulgence of day over the smiling earth, and regulating the changes of the seasons, and calling the wonders of vegetation from the solid land, while it causes the liquid seas to flow,—which performs all these wonders, and a thousand

more, and yet is so entirely under the control of man, and so subservient to his use, that it remains meekly glimmering amidst smouldering ashes in the grate, ready at his command, to cheer and enlighten his winter evenings, by blazing from a taper, or to employ its obsequious powers, for whatever purpose of culinary preparation, or of genial warmth, his necessities or enjoyments may require. What amazing power and wisdom is here, tempered, not less wonderfully, with all the tender condescension of Paternal kindness!

TENTH WEEK—SATURDAY.

III. MAN IN WINTER.—ADAPTATION OF HIS CONSTITUTION TO THE SEASON.

Besides the adaptation of external nature to the protection of man from the severities of winter, we have another proof of beneficent intention in the adaptation of the human constitution itself to the endurance of these severities. All animals are more or less endowed with this power of accommodation, yet none so much as those which are destined to be the companions and the aids of man; and man himself, assisted by the contrivances which his intellectual powers suggest, stands in this respect pre-eminent above them all. It was consistent with the beneficent intentions of the Creator, that the only rational race of beings on our globe, should be dispersed over every climate, and should carry intelligence and mental enjoyment, and a heart capable of feeling and acknowledging the Almighty Benefactor into every corner of the earth. We accordingly find, that the human frame can exist, not only under the vertical sun of the tropics, but under the chilling blasts and wide-spread snows of the polar regions.

It may be difficult for the physiologist to discover in

what this power of accommodation lies; but, that it does actually exist in a remarkable degree, the slighest acquaintance with the history and condition of the human race demonstrates. Every climate, indeed, and almost every country, exhibits some peculiarity in the constitution, and even in the external appearance, of the inhabitants, which indicates this power. The well known varieties in the colour of the skin, with its different shades of white, yellow, red, brown, and black, is an example of this. The colour of the eyes, and of the hair, and the shape of the nose, the cheek-bones, and the lips, are other familiar instances of a distinction of races in connexion with food and climate, as well as other local circumstances. I mention these as mere indications, for I do not know how far, or in what respects, any of them contribute to the accommodation in question. But the profuse perspiration of the Negro, under the heat of the tropics, and the stunted growth, and thick-set form of the Laplander, and native of Greenland, where food is scanty, and the cold intense, are less equivocal marks of wise and benevolent design. The perspiration diminishes the heat of the one, while the concentrated frame of the other preserves the animal warmth; and, while it probably increases the bodily strength, and thus gives additional power both of exertion and endurance, affords the faculty of existence on a diminished quantity of food. The state of the Negro is well known, and therefore need not be dwelt on; but, as the condition of the inhabitants of the polar regions is less familiar to the public, and comes more immediately under our present subject, it may be proper to show how far the view we have taken of their bodily constitution corresponds with their known habits and powers. Goldsmith, following Buffon, gives a most unamiable account of the personal appearance of the inhabitants of these inhospitable countries, including, under one description, the Laplanders, the Esquimaux Indians, the Samaoid Tartars, the natives of Nova Zembla, the Borandians,

the Greenlanders, and the Kamtschatkans. His description of their habits, however, shows them to be powerful, active, and patient of fatigue, cold, and hunger, to a remarkable degree. Speaking of the Laplanders, he says, "They make use of skates, which are made of fir, of nearly three feet long, and a half broad. With these they skate on the icy snow, and with such a velocity, that they very easily overtake the swiftest animals. With these skates they descend the steepest mountains, and scale the most craggy precipices; and, in such exercises, the women are not less skilful than the men. They have also the use of the bow and arrow, which seems to be a contrivance common to all barbarous nations; and which, however, at first required no small skill to invent. They launch a javelin also with great force, and some say that they can hit a mark no larger than a crown, at thirty yards distance, and with such force as would pierce a man through."

In reference to the whole race of the inhabitants of the extreme north, this author observes, that, "in proportion as we approach the pole, the size of the natives appears to diminish, growing less and less as we advance higher, till we come to those latitudes that are destitute of all inhabitants whatever;" and then he adds the following interesting and characteristic account:

"The wretched natives of these climates seem fitted by nature to endure the rigours of their situation. As their food is but scanty and precarious, their patience in hunger is amazing. A man who has eaten nothing for four days can manage his little canoe in the most furious waves, and calmly subsist in the midst of a tempest that would quickly dash a European boat to pieces. Their strength is not less amazing than their patience. A woman among them, will carry a piece of timber, or a stone, nearly double the weight of what a European can lift."

This general statement, which is intended to apply to several distinct tribes, is probably pretty accurate, so far

as it goes, though perhaps somewhat overcharged. Recent voyages and travels have made us better acquainted with the people of those regions, and some interesting facts, both with regard to the character of the inhabitants, and their mode of life, have come to light, as well as with regard to the peculiarities of soil and climate, and the nature of animal and vegetable productions, of which, in a few subsequent papers, we shall avail ourselves. Meanwhile, the reader cannot fail to be struck with the peculiar arrangements by which the most rigorous climates are accommodated to the subsistence of man; or to perceive, in these arrangements, the most distinct traces of an Intelligent Designer. It is true that, in the extremes both of heat and cold, there seems to be something unfriendly to the development of the mental powers; but still it is cheering and instructive to see every where provision made for that rational being, whom, of all his sublunary works, the Creator has endowed with faculties capable of discerning Himself, and offering up the thanksgivings of creation.

ELEVENTH WEEK—SUNDAY.

THE UNCEASING AND UNIVERSAL PROVIDENCE OF GOD.

There are many associations connected with this season of the year, which lead the religious mind to look back on past events, as well as forward to the future, in reference to the operations of that Divine Being, in whom we live and move. In contemplating these, we see a thousand things which, even to our diminutive understandings, appear to be insignificant, and a thousand more which seem to have happened contrary to reasonable expectations. Such considerations induce us to inquire if it be indeed true, that a God of infinite perfection presides over these events, and occupies Himself with the minute concerns of the little world we inhabit. The inquiry is at all times interesting.

It has already been remarked, that the perfections of the Godhead are manifested, not only in the large and magnificent scale of operations, to which the view of the starry heavens introduces us; but just as clearly and convincingly in the smaller, and, to our limited apprehensions, less important, arrangements of our terrestrial globe. Numerous evidences of this truth have come under our notice, in the compensations, adjustments, and contrivances, by which the general welfare of living beings is provided for, even in the bleak season of winter, and under circumstances apparently the most unfavourable.

Nor is it in created objects themselves, alone, but in their daily history also, that the same character is to be perceived; for the God who made, continues to preserve His creatures; and the same Hand, which wheels the planets in their orbits, and orders and arranges their daily positions, and their mutual attractions, is as divinely occupied in preserving the various races of His

terrestrial offspring, and in directing the daily occurrences by which their individual experience is distinguished.

That the Almighty watches over each of the beings He has made, and appoints its situation and its history, in all their varied vicissitudes, seems to follow from the fact, that He at first saw fit to create it; for, to imagine that God should have formed any creature, without having previously arranged the uses to which it should be put, the place it should occupy in the economy of creation, and the mode by which it should contribute to the advancement of his glory, is just to suppose Him such a one as ourselves,—ignorant and unsteady, fluctuating in his designs, and capricious in his conduct. Nor does the meanness of any of the creatures affect the question. The fact, that it has been esteemed worthy to be made, establishes the other fact, that, so long as it exists, its movements and its history must be ordered and superintended by God; and that the least noticed and most ordinary occurrences connected with it, are under His control. It requires, for this minute care and superintendence, no greater condescension, than for its original formation; and, if it be granted, that God is not degraded by the latter, it is inconsistent to imagine any degradation to attach to the former.

To every argument, therefore, used to support an opposite conclusion, it were enough to reply, that, as it is God's to create, so it is His to uphold; and, though to some of the creatures have been assigned a nobler place, and a higher destiny, than to others, the meanest, as well as the most exalted, must receive from God whatever care is necessary to enable them to fulfil the designs for which they were created. The seraph has his place assigned amid the glories of the celestial palace, where he is for ever and ever hymning the praises of his Creator. The pebble of the brook, whether it lies perpetually unnoticed among the stones in which it was originally imbedded, or serves, in the hand of one under the Divine

guidance, like that used by the stripling David, to smite an enemy of God in the forehead, has been made, and has had its place assigned, by the same infinite Jehovah. Both are equally the property of God, and each, in its own allotted place, is equally well suited for the ends for which it was intended. Both, therefore, are under the care of God, and each will be so ordered and guided, as to promote His eternal designs. That view of God's providence, which, affecting to place Him above the contemplation or the care of His creatures, however small or insignificant they may appear to us, divests Him of the glory attending the daily preservation of so many minute wonders, can only be adopted by one whose ideas of value are formed on the gross supposition, that bulk constitutes importance, and whose intellect is incapable of grasping the fact, that to the mind of God, whatever we can perceive of the vast and magnificent in creation, is but, after all, a point, requiring for its maintenance no greater trouble or care at His hands, than the little fly, which dances in the sunbeam, or the inanimate clod, which we tread beneath our feet.

From this doctrine may be deduced a sufficiently obvious, and no less important lesson—a lesson of faith and dependance on that God, by whom all things are arranged and governed. If even the tiniest insect is thus under His care, how much reason have we to feel satisfied that He will care for us. Such was the instruction deduced by our blessed Lord, from the same subject:—"Behold the fowls of the air, for they sow not, neither do they reap, nor gather into barns; yet your heavenly Father feedeth them. Are ye not much better than they? Consider the lilies of the field, how they grow; they toil not, neither do they spin. And yet I say unto you, that Solomon, in all his glory, was not arrayed like one of these. If God so clothe the grass of the field, which today is, and to-morrow is cast into the oven, shall He not much more clothe you, O ye of little faith?"

The providential care manifested towards us by our

Creator, is shown not only in the greater and more important events, but in every circumstance by which our lot is varied, however minute, or however trivial;—in the casual meeting of a friend, which seems to lead to nothing, as well as in the circumstances immediately connected with our birth, our conversion, our marriage, or our death. This will be the more readily granted, when it is perceived, that the distinction between trifling and important events cannot be accurately made by us, and that those which would generally be classed among the former, are very frequently the fruitful parents of the most momentous occurrences.

We need not go far for an illustration of this subject. It is a point, for example, in undisputed history, that Mohammed, when pursued by his enemies, ere his religion had gained a footing in the world, took refuge in a certain cave. To the mouth of this retreat, his pursuers traced him; but, when they were on the very point of entering, their attention was arrested by a little bird, starting from an adjoining thicket. Had it not been for this circumstance, the most trivial that can well be conceived, which convinced them that there the fugitive could not be concealed, Mohammed would have been discovered, and he and his imposture must have perished together. As it was, he effected his escape, gained the protection of his friends, and, by the most artful course of conduct, succeeded in laying the foundation of a religion, which now prevails over a large portion of the world, and numbers among its votaries the inhabitants of lands, neither insignificant in the map of the world, nor unimportant in their political relations. Thus, to the flight of a sparrow, may be traced the establishment of a delusion, whose moral influence has been deeply felt in the world, for more that one millennium already, and which will probably continue to exert a baneful effect on the character of many a people, till the very eve of that blessed period, when the kingdoms of this world shall become the kingdoms of the Lord, and of his Christ.

If an occurrence such as this has been so fruitful of events, to what circumstance shall we venture to give the name of trifling? Does not the history of every one of us testify to the influence of the very smallest and most unheeded of the occurrences by which it has been marked? Has not the falling of a leaf, or the waving of a branch moved by the gentle breath of heaven, suggested a thought, or led to a resolution fraught with important consequences to our future lives? And who can tell the thousand—thousand links, minute and unremembered, that have every one been necessary, in its own place, to bring about the end which has at length occurred,—the strange coincidences, the apparently accidental events, the meetings, the surprises, the conversations, the reflections, the very moods of mind which have entered into the composition of the final act, and which, had any one of them been different, even though that one had been the least noticed among the preparatory steps, must have led to a different result.

And, then, as to the importance of the chief events in the life of the humblest citizen, who can tell what an influence these may indirectly exercise over the happiness of his neighbourhood, or the fate of his country, or the destiny of the world? Had Hampden's spirit never been excited by the injustice of his rulers, who can tell what form of tyranny might now have been swaying the sceptre of our native land? and had Britain, at that era, slept on in her chains, instead of shaking off the yoke of her oppressors, who can say whether any nation in the world would at this moment have been free?

Thus constant, thus minute, is the providential care of God. As He is wise, let us look to Him for the ultimate adjustment of whatever appears to our short-sighted vision either distorted or unworthy of His character. As He is good, let us entertain the confidence, that they who serve Him in the gospel of His dear Son, shall be brought through all the vicissitudes of their earthly history, to the eternal mansions at last, and that, dark as the ex-

perience of his saints may be, He will cause all things to work together for their real good. G. J. C. D.

ELEVENTH WEEK—MONDAY.

I. ON THE INHABITANTS OF THE POLAR REGIONS.

We are naturally led, from the contemplation of man in winter, to view him placed, by the hand of Providence, amid the horrors of the Frozen Zone, where summer hardly ever penetrates, even in its least striking characteristics; where the solar heat is barely sufficient to dissolve, for a few months, the snow on the lower grounds, or the southern slopes, and to awaken the vegetable world to so languid a life, that even the hardier tribes of herbivorous animals find but a meagre subsistence. It would be difficult to conjecture any inducement which could have led originally to the voluntary occupation by man of so inhospitable and sterile an abode; and we are almost constrained to rest on the idea, that, in the accomplishment of the Divine intention of peopling the globe, the Supreme Governor has urged mankind, by some mysterious impulse, independent of his natural inclinations. Furnished with a power of accommodation to all climates, and aided and prompted, no doubt, by circumstances, man has often unconsciously fulfilled the first command of his Creator, "Be fruitful, and multiply, and replenish the earth." Issuing from the Plain of Shinar, to every point of the compass, the human race, after filling up the fertile regions of the Asiatic continent, radiated thence towards all the quarters of the globe; till, after the lapse of ages, they brought the most inhospitable regions, and most distant islands, under their dominion. In this process of dispersion, even the wastes of Siberia, and the snowy deserts

of Boothia Felix, received a portion of the human family. God, by whom they were conducted, and who had implanted within them an indomitable perseverance, and an amazing versatility of mind, had also prepared for them, even there, the means of subsistence; and, though hardships were to be encountered, and difficulties to be overcome, of which the inhabitants of more favoured climes were ignorant, there was spread for them, in the various kingdoms of Nature, a provision ample enough to satisfy all their real wants.

In illustrating this subject, I shall turn my attention, exclusively, to the state and character of those nations who are known by the general name of Esquimaux, and who dwell in the most northerly regions hitherto explored, I mean the higher latitudes of the Continent of America. Consulting those enterprising adventurers who have, in later years, penetrated the frozen seas, or wintered among the snows and storms of this extreme portion of the world, we shall thus be brought to understand how ample are the resources of Providence, even in the very coldest portions of the world; and, much more, how rich must be the provision made by the Creator in countries where the frost is less intense, and the rigours of the climate less severe. We shall find that objects, which, in temperate latitudes like ours, are regarded as useless or troublesome, are there capable of being turned to the most valuable account; that the snow, for example, which, to the delicate foot of the luxurious European, is cold, and damp, and disagreeable, grows in importance as we travel towards this ultimate corner of the earth. In the back woods of Canada, during the grim reign of winter, it affords the only means of transporting the produce of the land; and, what is very remarkable, forms a hard and easy path, for this purpose, at the very season when the convenience of the agriculturist demands it. But, in the native country of the Esquimaux, we shall find its value greatly enhanced, affording shelter and warmth, as well as facilities of easy transit. It

is true, we shall not discover, in these wild and miserable districts, accommodations either so choice or so convenient as in temperate regions: Nor will our general argument thereby be weakened. God, who has arranged the various conditions of the different orders of His creatures, has kindly bestowed upon some, advantages which he has seen meet to withhold from others; and, while we perceive that this is but consistent with the general system of His Providence throughout our degenerate world, it is enough for us to know, that, even amid the blackness and horrors of an Arctic winter, we can find ample reason to adore that goodness, which, under circumstances apparently hopeless, has provided a sufficiency for the sustenance of a considerable portion of His rational creatures.

The grand necessities of that remote people, then, may be considered under the several heads of Food, Clothing, Dwellings, Fire, and Light.

1. The daily food of the Esquimaux, as may well be supposed, is not directly derived from the soil. The land, perhaps in itself sterile, and at all events incapable, from the severity of the climate, of yielding a remunerating return for its cultivation, lies undisturbed by the hand of man, in all its original barrenness. Its spontaneous productions are few and of small value.

On the melting of the snow, the surface of the earth is found clothed with a stunted herbage, consisting chiefly of short coarse grass, affording a sufficient meal to the tribes of animals, which, during the winter months, had migrated to less sterile countries, but offering little to satisfy the cravings of the human appetite, and still less to provoke the indulgence of a luxurious taste. A few of the vegetable productions, indeed, are occasionally employed by the natives; but they are neither depended on as necessaries of life, nor cultivated for domestic purposes. Under these circumstances, the hardy natives are driven to the resources afforded by the animal productions with which, happily, their country abounds. Of

these we may mention several of the more remarkable. The smaller species of rein-deer which, in summer, are found in considerable numbers over the most northerly districts of America, and even among the islands of the Arctic Ocean, where they arrive in spring by crossing the yet unbroken ice, offer them a delicious banquet. These animals are tracked through the snow with that zeal and perseverance which generally characterize the hunting excursions of a barbarous people; and, notwithstanding their proverbial fleetness, fall victims, in great numbers, to the sure aim of the Esquimaux archers. The musk-ox is an an animal peculiar to very cold and inhospitable latitudes; and though, being sometimes of a savage temper, he needs to be approached with caution, is constantly pursued, as affording a principal article of food. At certain seasons, indeed, its flesh possesses a very strong and unpleasant flavour of that odorous production from which its name is derived; but, in general, it is highly palatable, and has often been eaten with relish by Europeans, who describe it as very similar in taste to beef. To these may be added the hare, the wolf, and the fox; the two last of which are caught in ingenious traps, baited with fish, or any sort of animal garbage, and are readily attracted to the neighbourhood of the snare, by setting fire to a little rancid oil or refuse fat. The flesh of the fox, strange as it may appear, is not only much esteemed by the Esquimaux, but even by European travellers, who, when fresh provisions were scarce, have often partaken of it with relish. In addition to these quadrupeds, it need hardly be remarked, that the Esquimaux are furnished, by the hand of their bountiful Creator, with an immense and most valuable supply of fish. The enormous whale and the delicious salmon, the walrus and the seal, are all made tributary to their daily necessities. They have exerted their ingenuity in the preparation of the staves, the spears, and other instruments employed in their capture; and these, though far indeed from the perfection exhibited in the

tackle of a European, manifest a greater share of the inventive faculties than we could easily have believed to belong to so rude and ungainly a people.

The immense quantity of fish taken and preserved by them, every season, for the supply of their winter necessities, almost exceeds our belief. But the contemplation of the exuberant abundance which their stores supply, while it leads to the conclusion, that no portion of the globe is so wild or inhospitable as to be destitute of proofs of the care and rich bounty of our Heavenly Father, awakens within us a sentiment of adoration, as well as of astonishment. "The earth is *full* of his goodness."

ELEVENTH WEEK—TUESDAY.

II. ON THE INHABITANTS OF THE POLAR REGIONS.—FOOD AND CLOTHING.

It is generally admitted by physiologists, that the activity of the human body, in the generation of internal heat, though dependant, in a great degree, on the original constitution, is powerfully affected by the quality, as well as the quantity, of the food consumed. It would moreover appear, that, to excite the heating powers of the living principle in man, there is nothing found by experience so valuable as an oily diet. In temperate regions, this fact is recognized by medical men, in cases of protracted rheumatism, in which the regular use of the oil extracted from the liver of the cod, is found highly beneficial in bracing the system to resist the effects of external cold, and enabling it, by an increased action, to banish the gnawing pains of that distressing complaint. Any one can tell how much, on exposure to the cold of a winter day in our own climate, hunger increases the chilly sensations of the body, and how much comfort a sufficiency of animal food is calculated to afford. A meagre diet is best adapted to a warm climate or season, agreeing well with the relaxed state of the body under an equinoctial sun, or the parching heats of summer; but affording no defence against the bitter effects of a severe frost. I believe it has been frequently remarked by persons familiar with the Polar Seas, that sailors of a full habit of body, a sanguine temperament, and a florid complexion, if in good health, are the least affected by the feeling of severe cold; and these are just the men most generally addicted to eating considerable portions of animal food. A thin and bilious person, on the other hand, who eats sparingly, and loathes a large proportion of fat or oily substances, finds it painful to be long exposed to the chilling influence of a northern sky. How remarkable an example of Providential care, then, does it appear, that, in those very regions where the internal heat of the body needs most to be excited, an inexhaustible supply exists, of the very description of food best suited to the purpose; and that, where the warmth of a summer sun never summons from the chilled and benumbed earth a vegetable provision for the calls of the human appetite, there should be found—what is far better—the oils and the fat with which the Arctic province of the animal kingdom so peculiarly abounds: Nor, must it be forgotten, that with this abundance there also exists a relish, on the part of the inhabitants, for substances, the mere odour of which, in the chamber where they are to be partaken of, is sufficient to expel with disgust a native of this country. The incredible quantity of this description of food, rancid as it is, which an Esquimaux is capable of devouring at a meal, has astonished the Europeans by whom it has been witnessed. Twenty pounds of salmon, for instance, is stated as no uncommon quantity to be devoured by an individual at a single meal. Excess, indeed, is followed, among them, as well as in more civilized nations, with its own punishment; but there can be no doubt, that

the cold of these regions is materially deprived of its painful effects on the human frame by eating as largely as nature will easily permit; so that the tendency to make a full meal, which is universally exhibited among them, and is no doubt a part of their constitution, must be looked upon as a collateral provision of the same wise over-ruling Power, liable indeed to abuse, but, when rightly regulated, calculated to promote the welfare of this remote people.

2. The *clothing* of the Arctic tribes, and especially of the Esquimaux, is almost entirely composed of furs. Providence, which has kindly adapted the coats of the lower animals in these regions, to the rigours of their climate, has thus, at the same time, brought within the reach of man the means of a warm exterior defence from the cold to which he is exposed.

Neither the flannels of more civilized countries, nor the skins of more southern climates, are at all to be compared to the valuable clothing with which, by the same exertion and ingenuity which are requisite to procure their food, they are furnished, among the hills and islands of their icy home. The long hair, which gives to the white bear and musk-ox their shaggy aspect; the rough coat of the rein-deer, the hare, and the fox,—cover a close warm downy inner garment of fur, rendered thicker by the first severe onset of winter, which effectually preserves the animal, for which it was originally provided, from the intensity of the northern storms; and, when snatched from its first owner by the lord of the lower world, affords to him a similar protection. Clothed in a double garment of deer-skin, encircling the body, and reaching in front from the chin to the middle of the thigh, and behind to the calf of the leg, with sleeves so long as to cover the points of the fingers; with the hair of the inner garment, as a warm exciting covering, next the body, and that of the outer one, from its roughness, extremely unfavourable to the radiation of heat, in the reverse direction; his limbs protected by two pairs of

boots, and, above these, trowsers of the skin of the seal or of the deer,—an Esquimaux can endure, without danger or inconvenience, a degree of cold, to which we, in this temperate zone, are utter strangers. Nor are we to imagine that the piercing climate, which has imposed the necessity for such defences, has had any effect in souring the dispositions, or lessening the enjoyment, of this singular race. On the contrary, they have generally been found remarkable for their good humour and easy temper. Their very dresses, frequently ornamented with fringes of leather, or tassels of bone, bear testimony that the hardships of their lot have neither cramped their taste, nor stifled their natural love of ornament. With an air of freedom and of personal comfort that can hardly be believed, while he enjoys the protection I have just described, the hardy native courageously braves an intensity of frost sufficient to congeal mercury. He proceeds on his journey, or pursues his prey, with a hilarity and keenness which testify, that the Being who has placed him among the horrors of his icy abode, has also afforded him ample means of defence and enjoyment.

G. J. C. D.

ELEVENTH WEEK—WEDNESDAY.

III. ON THE INHABITANTS OF THE POLAR REGIONS.—DWELLINGS AND FIRE.

3. In all climates, but more especially in the extreme north, it is a matter of indispensable importance to the inhabitants, to provide for themselves shelter from the inclemency of the weather. The lengthened journeys which these tribes are compelled by their necessities to undertake, the frequency of their removals, and the obliterating effects of falling snow, all tend to render it at once inconvenient and useless for them, even were it

practicable, to erect permanent dwelling-places. Had they wood, stone, and mortar at command, these materials would be to them of little avail. The villages of to-day, deserted to-morrow, and next day buried many feet beneath the snowy covering which enveloped, for so large a proportion of the year, the surface of their country, would, ere their return, be altogether useless, even if they were sure, at the end of several months, to find the spot on which they stood. But we need not say that such appliances as these are not within their reach. The wreck left by the southern wave, when it washes their shores, may sometimes, indeed, provide them with a tree, a mast, or a spar; but these materials are too eagerly coveted, and too valuable for constructing the smaller articles required by them, to leave any sufficient proportion for such purposes as building; while, of the architectural uses of stone and lime, they seem to be altogether ignorant. But for all these wants they are furnished, by the protecting Providence of God, with an ample and highly appropriate substitute, however strange it may appear to the inhabitants of temperate regions. The snow which covers the soil for by far the greater portion of the year, offers them the refuge which their necessities require. Migrating, as they do, from time to time, in search of food, at the close of each day's journey, they erect their temporary dwellings, at little expense either of materials or workmanship; and, when they reach the station which they propose to occupy for a few months, even then their mode of building is of the simplest sort. It is thus described by Sir John Ross:—

"Having ascertained, by the rod used in examining seal-holes, whether the snow is sufficiently deep and solid, they level the intended spot by a wooden shovel, leaving beneath a solid mass of snow, not less than three feet thick. Commencing, then, in the centre of the intended circle, which is ten feet or more in diameter, different wedge-shaped blocks are cut out, about two feet long, and a foot thick, at the outer part; then trimming them

accurately by the knife, they proceed upward, until the courses, gradually inclining inwards, terminate in a perfect dome. The door, being cut out from the inside, before it is quite closed, serves to supply the upper materials. In the mean time, the women are employed in stuffing the joints with snow, and the boys in constructing kennels for the dogs."* In the interior, the only furniture that is to be seen, consists of a sofa of snow, occupying nearly a third of the breadth of the area, about two feet and a half high, level at the top, and covered with various skins, forming the general bed or sleeping-place. The hut is lighted by a window of ice nicely inserted in the building, and secured by frozen snow; and the entrance is by a passage, long, narrow, and crooked, the outer aperture of which is planned, and from time to time altered, so as to secure the inmates from the prevailing winds of the season. The stores are laid up in smaller huts, constructed to receive them; and they, and the kennels for the dogs, which invariably accompany the tribes, are formed of the same material. It will naturally be conjectured, that such dwellings as have now been described, must be extremely cold, and liable, on any accession of artificial heat, to be rendered altogether uninhabitable, by the perpetual distillation of water from the icy walls. But there are several considerations which must be taken into the account, to enable us to judge of the suitableness of these habitations for the hardy race who occupy them. It must be noticed, in the first place, as a most important provision for their comfort, that snow is a very imperfect conductor of heat. The severe cold of the external air, therefore, makes but a small impression on the temperature of a chamber situated beneath a snow-wall of considerable thickness. Then, from its extreme whiteness, it is, comparatively speaking, little liable to be dissolved by the heat of a lamp or fire, being much more ready to reflect caloric than to absorb it. These facts, however, striking as they are, it is clear,

* Voyage, p. 298.

could not prevent the most annoying effects, were a strong heat constantly kept up within their circumscribed apartments. But here we find another important provision. The bodily frame, in all latitudes, speedily becomes inured, by habit, to the climate to which it is exposed, and the standard of temperature requisite for comfort accordingly rises or falls, as we live nearer the equator or the poles. While the African shivers under the summer warmth of the temperate zone, a degree of heat scarcely sufficient to raise the mercury to the freezing point affords to the patient Esquimaux, in his snowy hut, quite enough of warmth to make him comfortable; and, even if the temperature should, at times, be raised so high as to promote a rapid distillation from the walls, his ideas of luxury do not render this a very serious inconvenience. When we remember that it is not luxury which these rude tribes value, but simply shelter, we shall be less surprised with their contentment, especially when we learn that their clothing affords them sufficient security against the wetting influence even of melted snow. They experience quite as much of comfort as they desire, in finding themselves, during sleep, snug in their bags of fur, though the spot on which they lie be neither very dry nor very soft; for this defence, provided for them by the care of their Divine Preserver, answers to them all the ends for which it is needed.

4. In a region such as this, of frost and snow, of storm and tempest, it will easily be believed that the inhabitants are very dependant on fire, as a means of sustaining life; and the question will at once suggest itself, Whence can they derive fuel? Coals are unknown to them; and wood, we have seen, is much too valuable to be used for such a purpose. But they are not left destitute. Their little chambers are illuminated, during the whole course of their lengthened winter, by the cheerful, warm, and useful blaze of the lamp, which is replenished by oil from the seals yearly destroyed, in immense multi-

tudes, by the native hunters. We have seen how valuable to the natives of these Arctic Regions, is the oily nature of their diet. Here, however, we find that Providence had another end in view in affording to the inhabitants of these countries so large a supply of fat and oil as that which is obtained from several of the cetaceous tribes which frequent their stormy seas. Nor is this an end less essential to the preservation of human life. There, where no other fuel could be had, and where, without fire, the race of men must soon have become extinct, were fixed these living reservoirs of combustible fluid, which it only needed the exercise of reason, of perseverance, and of ingenuity, to bring within the power of the human family; by which a provision has been made for their wants, infinitely better suited to the circumstances of their lot, in their inhospitable deserts, than any other description of fuel that could be named. Coals would have required the assistance of large beasts of burden, and the convenience of roads to remove them from the pits to the places where they were to be consumed, and the very nature of the climate rendered both of these equally impossible to be obtained. Wood, even supposing it could have been had, would have been almost as inconvenient; but the seals are generally to be met with readily, and killed with ease, affording, for a moderate degree of labour and of ingenuity, not only an ample banquet, but a very considerable quantity of the best oil, to feed the flame on which their food, their drink, and their comfort mainly depend. How can we contemplate such facts as these, without admiring the goodness and the care of that God who has so liberally furnished the means of subsistence, even in this wild, desolate, and barren country! G. J. C. D.

ELEVENTH WEEK—THURSDAY.

I. FROST.—PROVISION FOR CAUSING ICE TO FLOAT ON THE SURFACE.

WITHOUT heat, every thing would be solid; the true way, therefore, of viewing liquids, is to consider them as solids in a melted state. Bodies melt at different temperatures, according to their capacity of receiving heat, and to the nature of the action which this subtle principle produces on their particles. Thus, it requires one degree of intensity to melt stone, another to melt iron, another to melt lead, and another still to melt ice. In this view, ice may be considered as the natural state of the element, and water to be nothing else than ice rendered liquid, like other substances, by heat. When the short continuance of the sun above the horizon in winter, and his oblique rays, have greatly diminished the force of his influence, he is no longer able to preserve water in a liquid state, and then the process of crystallization takes place, and ice is formed. But there is a remarkable difference between ice and other solid bodies, in the laws regulating its passage from a liquid to a crystallized state, which manifests beneficent intention.

Take water in its common state, and observe what occurs in reference to heat. It is the property of water, in common with other liquids, to communicate heat not so much by *conduction*, as it is called,—that is, by transmitting the temperature from particle to particle,—as by a motion among the particles themselves. Liquids, like solids, expand by heat and contract by cold. When heat, therefore, is applied to the bottom of a vessel, the expansion diminishes the specific gravity of the particles affected by it, and they rise to the surface, giving place to the colder and heavier particles, which again are heated in their turn, and ascend; and thus the process

proceeds, till the whole liquid is of equal temperature. In cooling, the opposite process takes place; the particles, as they become colder at the surface, subside, while others, of higher temperature, supply their place, and this interchange and mixture goes on till the whole body of the liquid becomes as cold as the surface. This remarkable property we have already noticed in speaking of the effect of the waters of the ocean in mitigating the temperature of different climates. Let us now see what would be the consequence if the same laws were to hold without limitation or exception. The cooled particles constantly descending, in virtue of their relative specific gravity, would, when the freezing point was reached, suddenly convert lakes and rivers, and the bed of the ocean itself, into a solid mass of ice, the congelation beginning at the bottom, and quickly spreading upward. Nor, when our deep waters were once frozen, would there be any natural means in existence by which they could be thawed to the bottom, because the heated particles, being the lightest, would constantly float at the top, and the warmth could only be diffused, as it is in solids, by the slower and less equable means of conduction. The experiment has been made, and water has been caused to boil by the application of heat to a vessel partly filled with ice, without thawing the congealed cake below.

Now, this would be attended with many disadvantages. The utility of our seas and lakes, in our own and similar latitudes, would be destroyed as means of commerce and of subsistence; and that element which, by its equal and mild temperature, contributes so essentially to the salubrity of all climates, from the tropics to the polar regions, would serve only to chill the atmosphere, and render even our temperate climates inhospitable.

Let us then attend to the modification of the law by which this inconvenience is provided against. Water continues to contract by the application of cold, till it approaches the freezing point; but here a most remark-

able deviation takes place. When it has cooled down to 40°, instead of continuing to contract, it suddenly begins to expand, and it proceeds in this new course, till, at 32°, it becomes ice. The fluid is, therefore, at its greatest density, when its temperature is just 8° above the freezing point; and hence the bottoms of our seas and lakes will be generally found, in winter, not to exceed that extent of coldness.* The coldest water, as it approaches the freezing point, rises to the surface. There the ice is formed, exposed to the first return of a more genial temperature, and ready to dissolve with the earliest influences of a warmer sun.

Another remarkable circumstance, which secures the floating of ice on the surface of the water, is, that in the very act of freezing, a farther expansion takes place. By this operation, the specific gravity of ice becomes less than that of water under any circumstances, and it is thus prevented from sinking to the bottom. Did no expansion take place in the process of congelation, ice would continue to float only so long as the water, on the surface of which it was formed, remained below the temperature of 40°. If the temperature happened to be raised above this point, it would immediately sink, and be overwhelmed, giving rise to various inconveniences, though not of so formidable a nature as those already alluded to.

It is not easy for the most sceptical to avoid the conclusion, that the marked and salutary deviation in this case, from the law by which matter is expanded by heat and contracted by cold, is an arrangement of an intelligent and beneficent Creator. The general rule is followed down to the point where it ceases to be beneficial; and then, by a sudden and surprising change, the very opposite rule takes place, by which disastrous effects are prevented, and various important advantages are secured. Where could we look for a clearer or more satisfactory proof of wise contrivance?

* It seems unnecessary to notice some remarkable facts which have lately attracted public attention, that appear somewhat to modify this conclusion, ice having been found formed at the bottom of some deep lakes.

"We do not know," says Whewell, "how far these laws of expansion are connected with, and depend on, more remote and general properties of this fluid, or of all fluids. But we have no reason to believe, that by whatever means they operate, they are not laws selected from among other laws which might exist, as, in fact, for other fluids, other laws do exist. We have all the evidence which the most remarkable furtherance of important purposes can give us, that they *are* selected, and selected with a beneficial design."*

ELEVENTH WEEK—FRIDAY.

II. FROST.—THE EXPANSIVE AND NON-CONDUCTING POWER OF ICE.

Our attention was yesterday directed to some of the peculiar provisions by which the freezing of water is so modified as to prevent the fatal effects that would ensue were the general law of expansion and contraction which regulates heated bodies, to operate without being arrested and altered. But there are one or two other beneficial operations of frost in our climate, which must not be passed without notice.

The expansive power of water, when passing into ice, has already been stated. This power operates with great force, as has been ascertained by experiment. A familiar instance occurs in the bursting of bottles filled with water or other liquids, when corked up and exposed to its influence. The same power affects the soil, when saturated with moisture, heaving up and separating the particles of earth and gravel. This sometimes acts disadvantageously, by throwing out the plants of young wheat, and by loosening the materials of which our

* Bridgewater Treatise, p. 85.

roads are composed; but it amply repays these partial inconveniences, by its pulverising effects on tenacious soils. Stiff loams, as they are called, that is, lands chiefly composed of an unctuous clay, though abounding in the vegetative principle, are yet naturally in an unfit state for successful cultivation. Their tenacity prevents the absorption and removal of the superfluous moisture during rainy seasons, and in drought renders the soil so indurated, as to obstruct the free growth of the roots of plants, and the secretion of sap. Now the agriculturist knows how to obviate these disadvantages, by the exposure of this kind of soil to the influence of frost. He ploughs up his land into furrows; and, by thus presenting it to the freezing process, finds that the water mingled with the soil, as it expands in being converted into ice, separates, with irresistible force, the adhesive particles of the clay; and, when again contracted, and rendered liquid by thawing, leaves the earth finely pulverised, and brought into a state well fitted for giving forth its prolific qualities in the ensuing year.

Another beneficial property of frost in the form of ice as well as of snow, is the power it possesses of confining the cold to the surface of the earth. The ice binds up the soil, and being a slow conductor, prevents the severity of the season from injuriously affecting the fibres and roots of the plants which nature has, in general, buried to a sufficient depth for their preservation, with the aid of this wise provision. Even when the ice reaches and envelopes the roots, it seldom materially injures them, because it does not easily descend below the freezing point, which is much higher than the usual temperature of the air in northern winters.

Here, again, we find cause of pious admiration. We do not expect a world of perfection; but the contrary. All climates have their inconveniences and evils: such is the condition of a fallen world; but then these disadvantages are always, in a wonderful manner, guarded, limited, and mitigated. They proceed to a certain point;

but there a Paternal hand interposes; and the sentence is pronounced as distinctly as if it were proclaimed with an audible voice, "Hitherto shalt thou come, and no farther." The obvious intention is discipline, and not destruction. In tropical climates, for example, the heat of a vertical sun, as we have seen, is not permitted to accumulate, by perpetual action on one point, as it would thus become intolerable. That great source of light and warmth is made continually to traverse from tropic to tropic; and when his direct rays would strike too fiercely in his passage there, the clouds collect with their shade, the rising winds fan the air, the cooling and fertilizing rains descend, and thus he moves along in his tempered glory, showering blessings from his wings at the moment when he threatened to scorch and destroy. And a similar arrangement is observable with reference to the opposite extreme of intense cold. The wintry blast seems calculated utterly to exterminate both the vegetable and animal creation; but by a series of deeply excogitated contrivances, the calamity is averted, and life and vigour are preserved in the vegetable world, while comfort and enjoyment are communicated to every thing that lives.

How curious and edifying is the analogy between the works of creation and the operations of Divine grace,—between the revelations of the book of Nature and of the book of Inspiration. When the curse fell on man, it was mitigated by the promise, that "The seed of the woman should bruise the head of the serpent;" when the earth was forbidden to yield him food, except as the fruit of painful toil, that very toil was converted into a source of pleasure and improvement.

Here is compensation; but grace goes far beyond the analogy of nature, for it promises heaven for earth,—the absolute and unalloyed blessedness of immortality, for the turmoils and stinted enjoyments of this mortal life. When the terrestrial paradise was closed against man for ever, his eye was directed, across a rugged and gloomy wilderness, and through a swelling flood, to that bright

spot in the distant horizon, where the wicked cease from troubling, and the weary are at rest; where a Father's hand wipes the tear from every eye; and where "joy unspeakable and full of glory" eternally reigns.

ELEVENTH WEEK—SATURDAY.

III. FROST.—AMUSEMENTS CONNECTED WITH IT.

A group of school-boys on the surface of a frozen pond or lake, is a most animated and interesting spectacle. There is so much evidence of real enjoyment in the motions, the accents, and the countenances of the various individuals who compose it, whether they glide along the ice on skates, or by means of the more humble instrumentality of wooden shoes, fenced with iron, or of a staff, armed with a pike, that a spectator, accustomed to reflection, cannot fail to recognize, in the happiness which prevails around him, an evidence of a benevolent Creator.

It might perhaps appear ludicrous, were I to assert that ice is formed smooth and hard, for the purpose of affording means of healthy and exhilarating sport to the young; and I might be reminded, that this is just the form which the crystallizing process takes in other instances, and the natural result of its laws. Be it so: but still it is impossible to deny, that the youthful mind is so framed as to take pleasure in the exercises which the smooth and level surface of the ice affords; and surely we do not go beyond the bounds of legitimate inference, when we assert, that this is one of the benevolent contrivances by which the rigours of winter are softened, whether the adaptation lie in the polished surface of the frozen plain, or in the buoyancy of the youthful mind, or in both. This observation may be greatly extended; for there is scarcely any object with which we are surrounded, that is not, to the well-constituted mind, a source of enjoyment. In the young this is more conspicuous, because the pleasurable feeling lies nearer the surface, and is more easily excited, and expressed more emphatically, by outward signs. But it would be a great mistake to measure the relative enjoyments of childhood and manhood by their external expression, or to suppose that nature, even in its most familiar aspects, does not present as many objects of interest, and of agreeable sensation, to those who are in the meridian of life, or even verging towards the shades of evening, as to those who flutter in the morning sunshine.

If the ice afford to the school-boy the joy of gliding swiftly on its smooth expanse, it is not niggardly of its amusements to the more sedate minds of the mature in age. To every northern country, some amusement on the ice is familiar; and, among these, that of *curling* may be mentioned as the game peculiarly prized in many districts of Scotland; and also, if I mistake not, in the Netherlands; from which latter country it seems to have been originally derived. The amiable Grahame, in his British Georgics, gives a graphic description of this amusement, an extract from which will not be unacceptable:—

"Now rival parishes and shrievedoms, keep,
On upland lochs, the long-expected tryst,
To play their yearly bonspeil. Aged men,
Smit with the eagerness of youth, are there,
While love of conquest lights their beamless eyes,
New nerves their arms, and makes them young once more."

* * * * * *

"Keen, keener still, as life itself were staked,
Kindles the friendly strife: one points the line
To him who, poising, aims and aims again;
Another runs, and sweeps where nothing lies.
Success, alternately, from side to side,
Changes; and quick the hours unnoted fly,
Till light begins to fail, and deep below,
The player, as he stoops to lift his coit,
Sees, half incredulous, the rising moon.

And now the final, the decisive spell
Begins; near and more near the sounding stones,
Some winding in, some bearing straight along,
Crowd justling all around the mark; while one
Just slightly touching, victory depends
Upon the final aim: low swings the stone,
Then, with full force, careering furious on,
Rattling it strikes aside both friend and foe,
Maintains its course, and takes the victor's place."

These are but single instances of the means of enjoyment, which brighten the gloom of winter. The benevolent Parent of nature enables the human mind to find a source of pleasure, as I have said, almost in every thing. Who has not felt his heart expand with an undefinable delight, when he has beheld the fantastic forms into which, during severe weather, the frozen spray or drippings of a cascade throw themselves, and when he has given loose reins to his fancy, in tracing crystal grottos, and temples, and spires, in the endless, but always elegant varieties of the architecture which the wizard Frost had reared? The very icicles dependent from the eaves of the houses, as they glance in the morning sun, are not beheld without a pleasing emotion; and a higher gratification to the taste is afforded in contemplating the white expanse of the snow as it spreads its bright and colourless carpet over the fields, and lies thick on the bending hedges and trees, while, at the horizon, the cold marble outline of the distant hills, swelling in the softened light, is finely contrasted with the dark blue of the serene and cloudless sky. Mr Abbott, a pleasing and amiable American writer, has touched, very beautifully, on the "thousand ingenious contrivances," as he calls them, which "God has planned and executed to make men happy," and he alludes, among other things, to the enjoyments of winter, in a few sentences, which will form an appropriate conclusion to this paper.

"You can give no reason," says he, "why the heart of a child is filled with such joyous glee, when the first

snow-flakes descend. There is no very special beauty in the sight; and there are no very well-defined hopes of slides or rides, to awaken *such* joy. At fifty, the gladness is not expressed so unequivocally; but yet, when the gravest philosopher rides through a wood, whose boughs are loaded with the snow, and whose tops bend over with the burden, and looks upon the footsteps of the rabbit, who has leaped along over the ground, he feels the same pleasure, though he indicates it, by riding on in silent musing, instead of uttering exclamations of delight. Can you explain this pleasure? Is there any *describable* pleasure in a great expanse of white? Is the form of the trees, or the beauty of their foliage, improved by their snowy mantle? No! The explanation is, that God, who formed the laws of nature, formed also the human heart; and has so adapted the one to the other, as to promote, in every variety of mode, the enjoyment of the beings he has made. There is no end to the kinds of enjoyment which God has thus opened to us every where. They are too numerous to be named; and no intellectual philosopher has ever undertaken the hopeless task of arranging them."*

* The Way to Do Good, p. 68.

TWELFTH WEEK—SUNDAY.

WINTER NOT MONOTONOUS.—BOUNDLESS VARIETY OF NATURE.

The winter landscape has been accused of monotony; and certainly all Nature has at this season a less animated and varied aspect than at any other. Unless when sprinkled over with hoar-frost, or covered with a cold mantle of snow, the surface of the earth is of a bleak and faded hue. The woods have long lost the variegated foliage, that had previously ceased to be their ornament; and the branches of the trees, with their "naked shoots, barren as lances," present one uniform appearance of death and decay. The howling of the long-continued storm, and the few faint bird-notes heard at intervals in the thickets or hedges, are monotonously mournful. The devastation of the earth, and the sounds that seem to bewail it, are general and unvaried. A few hardy plants and flowers, indeed, begin to swell their buds and expand their petals; but the thick cerements which envelope the one class, and the pale and sombre hue of the other, equally proclaim to the querulous mind the ungenial climate.

Such, at a cursory glance, appear to be the aspect and tone of our winter scenery. But the keenly observant eye discovers, even at this desolate season, and in the midst of seeming monotony, that endless variety which characterizes every province of creation. On close inspection, indeed, all we behold is varied. Whatever be the season, and wherever lie the scene of our observation, though many things are apparently similar, yet none are exactly or really so. At certain times and places, the mutual resemblances between all the common objects of sense, all that solicits the eye or the ear in the landscape, may be so numerous and striking, as to produce a feeling of monotony; groups of mournful sights and

sounds may, in the dead of the year, successively impress us with a sense of melancholy, and incline us to set a limit to the usual prodigality of nature; but yet true wisdom, aided by quick and active observation, easily draws the dull veil of uniformity aside, and reveals to the admiring eye boundless diversity even in the ravaged and gloomy scenery of winter.

Are the woods so uniformly dead, as, on a first survey, they appear? The oak, the ash, the beech, and most of our forest trees have lost their varied foliage; but, with the exception of the larch, the numerous varieties of the fir and the pine retain their leaves, and variegate the disrobed grove with their unfading verdure. In the woodland copse, or lonely dell, the beautiful holly still gladdens the eye with its shining and dark-green leaves. Nor are our shrubberies without their living green. The laurel and the bay defy the blasts of winter, and continue to shelter and beautify our dwellings. The flowers have not all vanished. One of the fairest, and seemingly one of the most delicate of them all, the Christmas rose, spots the garden or shrubbery with its bloom, unhurt by the chilling influences of the season. Before the severity of winter is over, the snow-drop emerges from the reviving turf, the lovely and venturous herald of a coming host. Thus, in the period of frost, and snow, and vegetable death, the beauty of flowers is not unknown; but rather what survives or braves the desolating storm, is doubly enhanced to our eyes by the surrounding dreariness and decay.

And are the atmospherical phenomena of this season monotonous or uninteresting? Independently of the striking contrast they present to those of summer and autumn, they are of themselves grandly diversified. The dark and rainy storm careers over the face of the earth, till the flooded rivers overflow their banks, and the forest roars like a tempestuous sea. The hoar-frost spangles the ground with a white and brilliant incrustation, or the snow, falling softly, covers the wide expanse of moun-

tain, and wood, and plain, with a mantle of dazzling purity. Then the dark branches of the trees, bending under a load of white and feathery flakes, have a picturesque aspect, and seem to rejoice in the substitute for their lost foliage. And how fantastically beautiful are the effects of frost! Water is transmuted into solid forms, of a thousand different shapes. The lake, and even the river itself, becomes a crystal floor, and the drops of the house-eaves collect into rows of icicles of varying dimensions, differently reflecting and refracting the rays of the mid-day sun. The earth is bound in magical fetters, and rings beneath the tread. The air is pure and keen, yet not insufferably cold. Calm and clear frosty days, succeeded by nights that unveil the full glory of the starry firmament, are intermingled with magnificent tempests, that sweep over the land and sea, and make the grandest music to the ear that is attuned to the harmonies of nature.

Variety seems to be a universal attribute of creation. It is stamped upon the heavens, the earth, and the sea. The stars are all glorious; but "one star differeth from another star in glory." The sun eclipses them all; and the moon reigns among them like their queen. The earth is covered with numberless mountains and hills, thick as waves on the ocean, and more wonderfully diversified. From the tiny hillock to the cloud-piercing peak, no two eminences are wholly alike in shape, or size, or in any single quality. What valley or plain, what tree, or flower, or leaf, or blade of grass, is, in all points, similar to another? Search the whole world, and you will find no pair of any of these created things exact counterparts to each other, in regard to weight, colour, structure, figure, or any other essential or accidental property. The animal world is as endlessly diversified. Not only is the distinction between the various genera and species wide and impassible, but between the individuals of each species, no perfect similarity exists. Twins are commonly most like each other;

but yet we are at no loss to distinguish between them. Even when we take two parts, however apparently alike, of two individuals of the same species, we find the same diversity. The variety observable in the human countenance has long been a matter of remark and admiration. The general features are the same in all; but their colour, their relative size, and numerous other particularities, are curiously different. Hence we can at once recognize an individual among a thousand, even when they are of the same stature and complexion with himself.

The diversity of colour is truly astonishing, and is the source of much beauty and enjoyment. Though the primary colours are only seven, yet these are so mixed and blended over all nature, as to delight the eye with thousands of different hues, of all degrees of depth and brilliancy. Let us look at a bed of blowing summer flowers, and behold the ravishing wonders of colour. The unstained silvery whiteness of the lily, the deep crimson of the rose, the dark and velvety blue of the violet, the bright yellow of the wallflower and the marigold, are but specimens of the rich and gorgeous hues that delight us with a sense of beauty and variety. The fields and lawns, with their bright green, spotted with white clover and crimson-tipped daisies; the meadows, with their butter-cups, and all their peculiar flowers; the woods, with their fresh spring verdure, and their flaming autumnal robes; and the mountains, at one time bathed in a deep azure, at another shining with golden sunlight, all exhibit the marvellously varied touches of that pencil which none but the Omnipotent can wield.

This universal variety is not merely a display of Infinite Skill, but is equally beautiful, pleasing, and useful. It adds immensely to our enjoyment of nature, and greatly enhances our idea of God's creative attributes. It furnishes us with the means of discrimination, without which the earth would be to us a scene of confusion. Were there only one colour, and were every mountain,

for example, of the same shape, or every shrub and tree of the same size, how dull and monotonous would be every landscape! And, if every human face were exactly alike, how should we be able to distinguish a friend from an enemy, a neighbour from a stranger, a countryman from a foreigner? Or, to take an example still more impressive, were the powers and passions of every individual mind in every respect similar, that diversity of character and pursuit which constitutes the mainspring of society and civilization, would not be found. In all this, there is adaptation and wise design.

Thus, amidst apparent uniformity, the necessary variety every where obtains. Nor does this variety ever run to excess. Utter dissimilarity is as rare as complete resemblance. All things are beautifully and usefully varied; but they also all wear the distinguishing mark of the same Great Artist, and can all be arranged into classes, the individuals of which bear to one another the most curious and intimate resemblances. There is in nature a uniformity that is as beneficial as variety itself. The leaves, flowers, and fruits of a tree or shrub, though astonishingly varied in their figure and appearance, are yet all so much alike, that they can easily be referred to their parent species. Of all the animals of a kind each has its peculiarities; but every individual can at once be recognized by the naturalist's practised eye. Thus has the author of all things so blended variety and uniformity together, as to delight, yet not bewilder us, with exhaustless novelty; to enable us to class his works into great groups of genera and species, and thereby to exercise our powers of reason and observation, in tracing the delicate resemblances and disagreements that meet us in all our inquiries. In the classification of these resemblances and disagreements philosophy is mainly employed; and but for them, the active and inquiring mind of man would find no motive for the exertion of its loftier powers. We live and move in a world of inanimate substances, infinitely diversified in form, colour,

and chemical properties, and intermingled with organic structures that ascend from the extreme of simplicity to all that is wonderful and complex in contrivance, and that possess almost every conceivable diversity in their essential qualities as well as their modes of existence; and to bring order out of this seeming confusion,—to observe, to generalize, and to classify,—to note the limitless variety of created things, and yet to discover the Divine harmony that pervades them all, is the noble province of the philosopher, and even of the humblest lover of Nature, who would enjoy aright the objects of his love, and adore with due intelligence the great Author and end of all.

O Lord! every quality of thy works is the result of Infinite Wisdom. The grand diversities of the seasons, with all their distinguishing characteristics, the beautiful harmony, and unlimited variety of nature, alike evince Thy goodness, and demand the cheerful gratitude of man. J. D.

TWELFTH WEEK—MONDAY.

IV. FROST.—EFFECTS OF IT IN THE NORTHERN REGIONS.

In passing from our own temperate climate, to higher latitudes, the rigours of winter are exhibited in a more unmitigated form, and the injurious effects of cold become more apparent. A slight sketch of the state of these regions, in relation to the phenomena of frost, may not be uninteresting.

Many of our readers are rendered familiar with the appearances of nature in the northern regions, by a perusal of the writings of our modern voyagers. From these some facts have already been selected, relative to the state of the vegetable and animal worlds, in the countries they visited; but, in the description of the in-

fluence of frost in that dreary climate, I prefer having recourse to an author less generally known. Captain Middleton gives a graphic and minute account of the effects of cold in the neighbourhood of Hudson's Bay, during winter, which is applicable, but with considerable aggravation, to the state of places still nearer the pole, where a dreary uniformity reigns. I shall abridge this narrative, so as to afford a condensed view of the subject, in its most striking features.

The ground was frozen, even in summer, to the greatest depth that had been penetrated, which, however, was not more than ten or twelve feet. No unfrozen spring of water could be found; and the lakes and rivers became, in winter, one solid cake of ice, fixed to the ground, when they did not exceed the depth of twelve feet. In large lakes and rivers, the ice was sometimes broken by "imprisoned vapours," and the rocks and trees, and even the joists and rafters of their buildings were not unfrequently burst with a noise as loud as the firing of a broadside by a man-of-war. If beer or water was left by the bedside, in cans, or bottles, or even in copper pots, in a severe night, they were sure to be split in pieces, before morning, by the expansive power of the ice in freezing. The air was filled with innumerable particles of ice, very sharp and angular, and plainly perceptible to the naked eye. All inland waters were frozen fast by the beginning of October, and continued so till the beginning of May. *Coronæ and parhelia*, that is, halos and mock suns, were very frequently observed. The aurora borealis was seen almost nightly. It shone with a surprising brightness, darkening all the stars and planets, and covering the whole hemisphere with a beautiful tremulous lustre. Seaward, the immense icebergs which crowded the scene, added greatly to the interest of the prospect. Some of these immense aggregations of ice are said to have been immersed a hundred fathoms* below the water, while they towered nearly a hundred

* This is probably an exaggeration.

feet above its surface, and extended in circumference to three or four miles.

The following amusing account is given of the clothing with which Captain Middleton, and his companions, defended themselves from the intense cold:—"For our winter dress, we make use of three pairs of socks, of coarse blanketing or frieze, for the feet, with a pair of deer-skin shoes over them; two pairs of thick English stockings, and a pair of cloth stockings upon them; breeches lined with flannel; two or three English jackets, and a fur or leathern gown over them; a large beaver cap, double, to come over the face and shoulders; and a cloth of blanketing over the chin; with yarn-gloves, and a large pair of beaver-mittens, hanging down from the shoulders before, to put our hands in, which reach up as high as our elbows."

I shall conclude this description of the rigours of a northern climate, with the interesting account given of a *ground-swell* in the ice, on the northern coast of Labrador, in Dr Brown's "History of the Propagation of Christianity." A party of Moravian missionaries were engaged in passing across an arm of the sea, on sledges drawn by dogs. The first alarm was given by some passing Esquimaux, and afterwards by their own attendants; but the approach of danger was at first scarcely perceptible, except on lying down, and applying the ear close to the ice, when a hollow grating noise was heard ascending from the abyss. By-and-by the wind rose to a storm, and the swell had increased so much, that its effects on the ice were extraordinary, and really alarming. "The sledges, instead of gliding smoothly along, as on an even surface, sometimes ran with violence after the dogs, and sometimes seemed with difficulty to ascend a rising hill. Noises, too, were now distinctly heard, in many directions, like the report of cannon, from the bursting of the ice at a distance. Alarmed by these frightful phenomena, our travellers drove with all haste towards the shore; and, as they approached it, the pro-

spect before them was tremendous. The ice, having burst loose from the rocks, was tossed to and fro, and broken in a thousand pieces against the precipices, with a dreadful noise; which, added to the raging of the sea, the roaring of the wind, and the driving of the snow, so completely overpowered them, as almost to deprive them of the use both of their eyes and ears. To make the land was now the only resource that remained; but it was with the utmost difficulty that the frightened dogs could be driven forward; and, as the whole body of the ice frequently sank below the summits of the rocks, and then rose above them, the only time for landing was the moment it gained the level of the coast—a circumstance which rendered the attempt extremely nice and hazardous. Both sledges, however, succeeded in gaining the shore, though not without great difficulty. Scarcely had they reached it, when that part of the ice from which they had just escaped, burst asunder, and the water, rushing up from beneath, instantly precipitated it into the ocean. In a moment, as if by a signal, the whole mass of ice, for several miles along the coast, and extending as far as the eye could reach, began to break and to be overwhelmed by the waves. The spectacle was awfully grand. The immense fields of ice, rising out of the ocean, clashing against one another, and then plunging into the deep with a violence which no language can describe, and a noise like the discharge of a thousand cannon, was a sight which must have struck the most unreflecting mind with solemn awe. The brethren were overwhelmed with amazement at their miraculous escape; and even the pagan Esquimaux expressed gratitude to God for their deliverance."*

* Brown's History of the Propagation of Christianity among the Heathen, vol. ii. p. 51.

TWELFTH WEEK—TUESDAY.

V. FROST.—ITS AGENCY IN MOUNTAINOUS REGIONS.

I HAVE already mentioned, that water suddenly expands in the process of freezing; now the force with which the expansion takes place is immense, as has been proved by various experiments. The barrel of a gun, and even the body of the strongest cannon, when filled to the muzzle with water, and tightly screwed up, have been found to burst under this process in a hard frost; and, indeed, there does not appear to be any known power in the material world strong enough to resist it. This property seems to be one of the most active agents in breaking down rocks and diminishing the height of mountain ranges, particularly in regions distant from the equator. The water which penetrates the fissures of the rocks during the early part of the winter, is converted into ice, and, by the sudden expansion which then takes place, rends the solid rocks asunder, with a noise which is heard at the distance of many miles; and, where the surface happens to be precipitous, and the equilibrium is destroyed, the detached masses, on the melting of the ice, by the return of spring, fall over with a tremendous crash, and, in the fearful avalanche, sometimes overwhelm whole villages and fields, carrying sudden and inevitable destruction to their inhabitants. Most distressing occurrences from this cause take place every year in those lofty and rugged districts where nature has formed so strong a barrier against the encroachments of hostile armies, and where freedom so long maintained her throne, and religion her purity and independence, in the midst of enslaved and degraded kingdoms. In the narrow valleys of the Swiss Cantons, and along the ravines formed by those tributary streams which supply the ample currents of the Rhine and the Rhone, winter has terrors altogether unknown to the inhabitants of less

Alpine territories. Sometimes an avalanche blocks up the channel between two mountains, till the accumulated waters of weeks or months force for themselves a passage, and, rushing forward with a tremendous flood, carry far-spread inundation and death over the smiling and well-peopled valleys below. In other places, year after year, on the breaking up of the winter storms, rocks and stones rolling down the sides of the mountains, gradually but surely, overwhelm whole districts, which the industry of man had rendered fertile, and cause them to be abandoned to the eagle, the marmot, and the chamois. These encroachments are fearful, while others, of a description scarcely less formidable, occur in different situations of the same interesting ranges. Not unfrequently, the majestic glacier, undermined by some mountain stream, or rendered unstable by the accumulating snows and frosts of ages, gives way in an instant, and, toppling over from its giddy height, tumbles headlong to the lower grounds; not only bearing extensive destruction in its fall, but chilling, for many years, the climate of all the surrounding district with its wintry breath.

Such calamitous events remind us, that we live in a world, among the conditions of which are desolation and suffering; and they carry our thoughts upward to that happy land where there is no death, no calamity, no change,—where trials are past, and tears are wiped away; and where the dark valley, and the narrow path, have ended in a boundless and glowing paradise of eternal sunshine and unfading bloom.

In one point of view, the events I have adverted to, are of importance in the controversy with the atheist, who dreams of the eternity of matter, and an eternal succession of uncreated beings. The process of decay which is so actively going on in our mountain ranges, is an undeniable proof of the comparatively recent formation of these rugged elevations, and, by a necessary consequence, of the present surface of the globe, of which they

form so extensive and so essential a feature. It is impossible that they could have existed from eternity, or even for any period to which the power of calculation cannot easily extend. Had the earth endured without disruption for a million of years, for example, long ere now the power of frost, and other causes of decay, would have crumbled to dust the hardest projecting rocks, levelled the highest mountains, and reduced the whole surface of the globe to a marshy and unwholesome plain. Our world has neither existed from eternity, nor is it formed for eternal existence. While the frost rends asunder matter subjected to its influence, the air decomposes it, the storm scatters it, the rain washes it away, rivers and overwhelming torrents carry it to the valleys and the ocean; the formation of downs, the fall of forests, and the decay of vegetation, are continually altering the relative depth of the low grounds by their accumulations. "Ages on ages might indeed pass away before these agents could produce their extreme effects, yet that their action is neither inconsiderable nor very slow, innumerable observations have rendered incontestable."*

Now, long before the earth had arrived at the point to which it is so evidently tending, the fall of the mountains would render it a comfortless and noxious habitation. Our springs and rivers would be absorbed and disappear in fetid swamps; the winds and rains, on which mountainous districts produce such salutary effects, would cease to be equably dispersed; in one extensive region, the stagnant atmosphere, loaded with poisonous vapours, would spread pestilence and death; and in another, winds, blowing continually and violently from one point of the compass, would shed a blight over both the vegetable and animal world. The wide spread and desolate Steppes of Russia, in short, where nothing is seen on every side but a cheerless and level waste, and where, from horizon to horizon, a death-like silence reigns,

* Bushnan's Study of Nature.

would be but a faint picture of the miserable scene, which a decayed world would present to its last sickly and dying inhabitants.

But the earth is not destined to arrive at this state of feeble and decrepit age. Thousands of centuries before that period would arrive, its task will be accomplished, and its race run; for the irreversible decree of the Creator is, that at no distant period, "The heavens being on fire shall be dissolved, and the elements shall melt with fervent heat; the earth also, and the works that are therein, shall be burnt up." Yet how cheering is the promise with which that decree is accompanied,—that there shall be the creation or development of "New heavens, and a new earth, wherein dwelleth righteousness;" and how appropriate is the exhortation of the apostle, "Wherefore, beloved, seeing that ye look for such things, be diligent, that ye may be found of Him in peace, without spot and blameless."*

TWELFTH WEEK—WEDNESDAY.

VI. HOAR-FROST.—FOLIATIONS ON WINDOW-GLASS.

THERE are some beautiful appearances which frost frequently assumes, to cheer us, as it were, and give an agreeable exercise to our taste, in the absence of that loveliness, which the hand of an indulgent Creator sheds so profusely over our fields and gardens, in the genial months of spring and summer. I have already noticed the fantastic forms which ice assumes at a waterfall, and the pleasure which arises in the mind, on contemplating the loaded woods, and the undulating surface of the earth, after a fall of snow. Nature is almost always either grand or elegant; and, when it is otherwise, the very contrast is a source of enjoyment. In other words,

* 2 Peter, chap. iii.

the mind is so constituted as to derive pleasure from all the aspects of the external world. But there are some things better adapted than others to afford gratification to the taste; and, when I mention hoar frost, a thousand agreeable recollections will arise in every mind. This appearance is occasioned by the freezing of the mist or dew,* and seems to be the result of a process similar to that by which snow is formed in the higher regions of the atmosphere. There is this difference, however, that the snow is formed from the rain-drops or humid clouds suspended in the air, without any solid nucleus to which they can adhere; while the hoar-frost is usually elaborated on the blades of grass, or branches of trees, or other substances with which the moist particles come in contact. It is a well-known law, that water does not readily freeze, unless it have some solid substance on which it can form. It is on this account that, in a pond or lake, we always see the first appearance of ice either along its margin, or shooting out in long beautiful feathers from some random stick or stone projecting on its smooth surface. In obedience to the same law, the watery particles floating in the air, after being exhaled from the surface of the earth, although they are at, or even below, the freezing point, retain their fluid state when the frost is not very intense, till they meet with something solid, when they instantly become crystallized, and are deposited on the trees, the hedges, and the spreading meadows, in those elegant forms which so far excel the frost-work of art. This happens frequently in an atmosphere entirely clear; and indeed a cloudless sky is essential to that rapid evaporation from the earth's surface, which

* The phenomena of dew, and of hoar-frost, when it arises from dew, are owing to the radiation of caloric from the surface of the earth, without any interchange from the sky. "The caloric radiated during the night," says Mrs Somerville, "by substances on the surface of the earth, into a clear expanse of sky, is lost, and no return is made from the blue vault, so that their temperature sinks below that of the air, whence they abstract a part of that caloric which holds the atmospheric humidity in solution, and a deposition of dew takes place. If the radiation be great, the dew is frozen, and becomes hoar-frost, which is the ice of dew."

gives rise to an abundant dew; but we often observe the hoar-frost also produced by a dense haze, which broods over the surface of the low grounds, during the night, in the form of a sluggish cloud, and which is dissipated by the first rays of the rising sun. In this latter case, the snowy incrustation is thicker and more general, and the effect is like enchantment. The scene which, at nightfall on the preceding evening, was bleak and cheerless, is all at once converted into fairy land. Every vegetable substance, from the blades of grass which lay drooping in the naked fields, to the polished leaves of the evergreen and gnarled branches of the lofty forest oak, is suddenly fringed or clothed with a garniture of purest down, whose beauty surpasses the poet's dream, and is scarcely less substantial or less fleeting.

Another most beautiful effect of frost, which, however, is only rarely observed in this climate, where the alternation from comparative warmth to intense cold is not so sudden as in some other countries, is finely described in the following well known passage of a poetical letter from Copenhagen, by Mr Phillips:—

"Ere yet the clouds let fall the treasured snow,
Or winds began through hazy skies to blow,
At evening, a keen eastern breeze arose,
And the descending rain, unsullied, froze.
Soon as the silent shades of night withdrew,
The ruddy morn disclosed at once to view
The face of Nature in a rich disguise,
And brightened every object to my eyes:
For every shrub, and every blade of grass,
And every pointed thorn, seemed wrought in glass;
In pearls and rubies rich the hawthorns show,
While through the ice the crimson berries glow;
The thick-sprung reeds, which watery marshes yield,
Seem polished lances in a hostile field.
The stag, in limped currents, with surprise,
Sees crystal branches on his forehead rise.
The spreading oak, the beech, and towering pine,
Glazed over, in the freezing ether shine.
The frighted birds the rattling branches shun,
That wave and glitter in the distant sun.
When, if a sudden gust of wind arise,
The brittle forest into atoms flies;
The cracking wood beneath the tempest bends,
And in a spangled shower the prospect ends."

Nor must I omit to mention yet another pleasing production of frost, in the elegant and varied foliations which are formed on the glass of windows. This appearance takes place most remarkably in cases where the air within the room happens to have been much impregnated with moisture, either from the human breath, when several individuals have been collected, or from any other cause. The coldness of the glass causes the floating vapour to be condensed on its surface, where it shoots out, as it freezes, into those flowery crystals, which excite our admiration. The precise cause of this phenomenon may be obscure, like every other phenomenon of congelation; but the effect is at once curious and pleasing; while, if we trace it up to that law, of which it is only an example, it will acquire a higher importance, and be found to be connected with a principle of vast magnitude in the world of unorganized matter; for the crystallizing process (and freezing is nothing else), seems to form the link between unorganic and organic substances; by the regular structure of its productions, mysteriously uniting crude matter with the vegetable and animal creations.

The pious Sturm, in speaking of this phenomenon, views it in a light different, indeed, but not less important, while his reflection equally applies to the other appearances of frost, which we have been examining. "Can an object be considered as little," says he, "when it furnishes matter for useful reflection? For my own part, I do not disdain to read, even on the frozen glass, a truth which may have a great influence on my happiness. Behold the flowers which the frost has portrayed on the glass! They are beautifully and artificially va-

ried; nevertheless, one ray of the noonday sun effaces them. Thus the imagination paints every thing beautiful to us; but every thing which it represents as attractive in the possession of the goods of this world, is but a beautiful image which shall disappear in the light of reason. The importance of this lesson of wisdom was worth the trouble of stopping for a while, at the little phenomenon which furnishes it."

TWELFTH WEEK—THURSDAY.

VII. FROST—BENEFICENT CONTRIVANCES RELATIVE TO SNOW.

As the influence of cold is felt in the air, as well as on the surface of the earth, and indeed becomes more intense, in proportion to the elevation, it must affect the moisture which floats in the atmosphere. The rain-drops must freeze, and, when frozen, must be precipitated to the ground. Now, were this process to take place in the same manner as it occurs on the face of a lake or pond, and were the water in the clouds to be converted into solid lumps of ice, the most unhappy consequences would ensue, as may be inferred from the damage occasioned by a hail-storm,—an occurrence which sometimes but rarely happens, as if to call our attention to the beneficent provision by which this calamity is usually obviated. The fruits of the earth would be destroyed; or, if the season of fruits was past, at least the branches and embryo buds of plants and trees would be shattered; birds on the wing, or on the perch, would be struck to the ground, stunned and dying; the more tender quadrupeds would receive their death-blow; and even the hardy races of animals, and man himself, would not escape material injury. None of these consequences, however, actually take place, because the frozen rain-drops descend, not in the form of ice, or even usually in the

less destructive form of hail, but on the downy wings of virgin snow.

Let us consider, then, the properties of snow, and we shall not fail to admire the wisdom of the provision. The vapour floating in the atmosphere is arrested by the cold, and is frozen; but, instead of running together, as might be expected, into solid masses, it unites with the nitrous particles, also to be found mingled with the air, and, forming a compound crystal, shoots out into beautiful feathery flakes. Whoever will take the trouble to examine one of these flakes with the aid of a microscope, cannot fail to admire the elegance and skill of its structure. He will observe many little sparkling crosses or darts radiating from a point, and branching off and meeting in all directions, so as to form hexagonal lines of much beauty, wrought apparently with the nicest art, and wonderfully fitted for passing, with a buoyant and flickering motion, through the air, so as to drop, without disturbance, on the ground, spreading a coat of dazzling whiteness, profusely, but gently, over bush and brake, lawn and mountain. It has been found by experiment, that "snow is twenty-four times lighter than water, and that it fills up ten or twelve times more space, at the moment of falling, than the water produced from it when melted."* This is an admirable contrivance, to prevent, or at least to modify, what would otherwise prove a great evil.

Another useful property of snow has been noticed by many writers, and is verified by yearly experience. Being a very imperfect conductor of heat, it does not readily descend below the freezing point, and thus tempers the rigour of the season. Under its white covering, the earth remains of a moderate and equal temperature, and the bulbs and roots of plants are preserved from the ungenial influence of a severe sky. In consequence of the same slowness in the conduction of heat, the Arctic traveller can sleep, without much inconvenience, on his

* Sturm's Reflections, January 26.

bed of snow, which is warm compared with the atmosphere he breathes; and, for the same reason, the snow-formed hut affords the Esquimaux no unpleasant abode.*

Nor must we forget to remark, with reference to the effects of snow on the soil, that the nitrous particles which it contains, are said to be of a fertilizing quality, and, as it gradually melts, these particles penetrate the earth, being carried to the roots of the plants, mingled with the water into which it is converted. Assuming the accuracy of this latter observation, we shall find abundant cause for admiring an arrangement, which, in various ways, converts an apparent curse into a blessing, changing that which seems to be an aggravation of this inclement season, and a source of sterility, into a protection from the cold, and a means of future fruitfulness.

But there is yet another arrangement, in reference to this subject, which must not be overlooked. When the weather changes, which it sometimes does very suddenly, the greatest inconveniences, and even calamities, would ensue, were the effect of this change to operate, as might, without experience, be expected, in producing an instantaneous conversion of the snow into water. If the frost were as quickly expelled from water as from the air, the moment that the temperature rose above 32°, the snow would become liquid as by magic, the ice would vanish like a dream from river and lake, and the rigid earth would, on the higher grounds, be in an instant converted into a swamp, and in the valleys would be overflowed, and swept away by mountain torrents. A very peculiar and remarkable property prevents these disastrous effects. In the act of dissolving, the water absorbs a quantity of heat, and retains it in a *latent* state; and, on this account, the melting process cannot take place till a sufficient quantity has been absorbed. This necessarily causes the process to be slow; and days, and even weeks, may pass away, after the thaw has begun, before the ice entirely disappears from our ponds, or the

* Whewell's Bridgewater Treatise, p. 90.

snow from our hills. The advantageous consequences of this retardation, are too obvious to require further illustration; but it is of importance to remark, that it is effected, not as a result of an ordinary and general law, but rather by what has been justly called the apparent *violation* of a law. A sudden stand, as it were, is made in the progress of the change. The alteration of temperature, instead of producing its ordinary effects, becomes, all at once, apparently feeble and languid in its operations; the heat, as it is applied, disappears, and its dissolving power is restrained within such bounds, as to render the process comparatively innoxious.

A similar effect is produced in the *boiling* of water. At the boiling point, as well as at the thawing point, a sudden stoppage takes place, and the heat applied becomes *latent*, so as to preserve the water at that point, till it is gradually carried off in the form of steam. It is this property which renders water so useful in the various operations of the kitchen and the manufactory. If the whole volume of the water we employ were to be instantly converted into steam, when it arrived at the boiling point, which would certainly be the case, were it not for the peculiar property of which we are speaking, how much would be detracted from the usefulness of this most useful element!

Here, then, we have a wonderful modification of a general law, the beneficial nature of which is as manifest as the property itself is remarkable. Can we do otherwise than attribute it to the contrivance of an intelligent Creator?

The striking appearance of a landscape covered with new-fallen snow, and the effects produced on the lower animals by its fall, are thus graphically described by the poet of the Seasons:—

> "The cherished fields
> Put on their winter robe of purest white.
> 'Tis brightness all; save where the new snow melts
> Along the mazy current. Low the woods

Bow their hoar heads ; and, ere the languid sun,
Faint from the west, emits his evening ray,
Earth's universal face, deep hid and chill
Is one wild-dazzling waste, that buries wide
The works of man. Drooping, the labourer-ox
Stands covered o'er with snow, and then demands
The fruit of all his toils. The fowls of heaven,
Tamed by the cruel season, crowd around
The winnowing store, and claim the little boon
Which Providence assigns them. One alone,
The red breast, sacred to the household gods,
Wisely regardful of the embroiling sky,
In joyless fields and thorny thickets, leaves
His shivering mates, and pays to trusted man
His annual visit. Half afraid, he first
Against the window beats ; then brisk alights
On the warm hearth ; then, hopping o'er the floor,
Eyes all the smiling family askance,
And picks, and starts, and wonders where he is ;
Till, more familiar grown, the table crumbs
Attract his slender feet. The foodless wilds
Pour forth their brown inhabitants. The hare,
Though timorous of heart, and hard beset
By death in various forms,—dark snares, and dogs,
And more unpitying men,—the garden seeks,
Urged on by fearless want. The bleating kind
Eye the bleak heaven, and next the glistening earth,
With looks of dumb despair ; then, sad, dispersed,
Dig for the withered herb through heaps of snow."

TWELFTH WEEK—FRIDAY.

SAGACITY AND FIDELITY OF THE DOG IN SNOW.

I WELL remember with what delight I listened to an interesting conversation, which, while yet a schoolboy, I enjoyed an opportunity of hearing in my father's manse,*

* Lochrutton in Galloway.

between the poet Burns, and another poet, my near relation, the amiable Blacklock. The subject was the fidelity of the dog. Burns took up the question with all the ardour and kindly feeling with which the conversation of that extraordinary man was so remarkably embued. It was a subject well suited to call forth his powers, and, when handled by such a man, not less suited to interest the youthful fancy. The anecdotes by which it was illustrated, have long escaped my memory ; but there was one sentiment expressed by Burns, with his own characteristic enthusiasm, which, as it threw a new light into my mind, I shall never forget. "Man," said he, "is the god of the dog. He knows no other ; he can understand no other :—And see how he worships him! With what reverence he crouches at his feet, with what love he fawns upon him, with what dependance he looks up to him, and with what cheerful alacrity he obeys him! His whole soul is wrapped up in his god ; all the powers and faculties of his nature are devoted to his service ; and these powers and faculties are ennobled by the intercourse. Divines tell us that it ought just to be so with the Christian ; but the dog puts the Christian to shame."

The truth of these remarks, which forcibly struck me at the time, have since been verified in my own experience ; and often have events occurred which, while they reminded me that "man is the god of the dog," have forced from me the humiliating confession, that "the dog puts the Christian to shame."

The dog was certainly created to be a companion and assistant to the human race. It is well observed by Goldsmith, that the generality of animals have greater agility, greater swiftness, and more formidable arms, from Nature, than man ; their senses, and particularly that of smelling, are often far more perfect. This is the case with the dog ; the having gained, therefore, a new assistant, in this sagacious and quick-scented animal, was the gaining of new powers, of which man stood in

need. There are various important services rendered to man by the dog, which may be more properly noticed afterwards. At present, I shall confine myself to a few instances, in which he contributes, by his docility, his sagacity, and his attachment, to lessen the dangers of the winter storm, or to mitigate, by his useful labours, the rigours of an ungenial climate.

I begin by abridging Captain Parry's account of the manner in which dogs are employed by the Esquimaux, in conveying them from place to place in sledges over the ice or frozen snow;—premising that dogs of this species are somewhat smaller in size than those of Newfoundland, and bear a strong resemblance to the wolf of their native country, and that they have very firm bone in their fore-legs, with great strength in their loins, two essential qualities for the purposes of draught. When drawing a sledge, the dogs have a simple harness of deer or seal-skin going round the neck by one bight or loop, and another for each of the fore-legs, with a single thong leading over the back, and attached to the sledge as a trace. Though they appear at first sight to be huddled together without regard to regularity, there is, in fact, considerable attention paid to their arrangement, particularly in the selection of a dog of peculiar spirit and sagacity, who is allowed, by a longer trace, to precede the rest as a leader, and to whom, in turning to the right or left, the driver usually addresses himself. This choice is made without regard to age or sex, and the rest of the dogs take precedency according to their training or sagacity, the least effective being placed nearest the sledge. The leader is usually from eighteen to twenty feet from the forepart of the sledge, and the hindmost dog about half that distance; so that, when ten or twelve are running together, several are nearly abreast of each other. The driver sits quite low, on the forepart of the sledge, with his feet overhanging the snow on one side, and having in his hand a whip, of which the handle is eighteen inches, and the lash more than as many feet in length.

The men acquire from their youth considerable expertness in the use of the whip, the lash of which is left to trail along the ground by the side of the sledge, and with which they can inflict a very severe blow on any dog at pleasure. The dogs are kept in training entirely by the fear of the whip; but in directing the sledge it acts no very essential part, the driver for this purpose using certain words, as waggoners do with us, to make the dogs turn to the right or left. To these a good leader, when admonished by name, attends with admirable precision, at the same time looking behind over his shoulder with great earnestness, as if listening to the directions of the driver. With "good sleighing," that is, on good roads, six or seven dogs will draw from eight to ten hundred weight, at the rate of seven or eight miles an hour, for several hours together. With a smaller load they will run ten miles an hour, and are, in fact, almost unmanageable. To the women, who nurse them when ill, and treat them with greater kindness than the men, they are affectionate in the highest degree. From the men they receive little, except blows and rough treatment;—still they are faithful and enduring.

Another dog, of a kind not dissimilar to that of the Esquimaux, performs to man, in a different region, a service of a different kind, for which still greater sagacity is necessary. I allude to the Alpine spaniel, which is employed by the monks of the convent of the great St Bernard, on their errands of humanity. This convent is situated near the top of that high mountain, not far from the region of perpetual snow, where the traveller is often suddenly overtaken with the most severe weather, and is liable to a thousand accidents. The sun becomes suddenly darkened; the wind howls; the snow comes in swirls through the air, and drifts up his path; the fatal avalanche falls from the impending cliff, and sweeps trees and rocks into the valley, along with the helpless passengers, or buries them deep beneath its thundering mass. The pious and generous monks devote themselves

in this region of horrors to offices of humanity; and in their truly Christian task they are admirably assisted by a noble breed of dogs, whom they have trained, and keep in their establishment, for the purpose of rescuing travellers from destruction. Benumbed with cold, weary in the search of a lost track, his senses yielding to the stupifying influence of frost, which betrays the exhausted sufferer into a deep sleep, the unhappy man sinks upon the ground, and the snow drift covers him from human sight. It is then that the keen scent and the exquisite docility of these admirable dogs are called into action. Though the perishing man lie ten, or even twenty feet below the snow, the delicacy of smell with which they can trace him, offers a chance of escape. They scratch away the snow with their feet, and they set up a continued hoarse and solemn bark, which brings the monks and labourers to their assistance. To provide for the chance, that, without human help, the dogs may succeed in discovering the unfortunate traveller, one of them has a flask of spirits round his neck, to which the fainting man may apply for support, and another carries, strapped on his back, a cloak to cover him. These wonderful exertions are often successful. One of those noble creatures was decorated with a medal, in commemoration of his having saved the lives of twenty-two persons, who but for his sagacity must have perished. He himself, however, met an untimely fate in 1816, in an attempt to convey a poor Piedmontese courier to his anxious family. The traveller, with two guides and this remarkable animal, were descending the mountain, and some members of his family were toiling upward in search of him, when two avalanches overwhelmed them all in one common destruction.*

The shepherd's dog of Britain is not less susceptible of training than the Alpine spaniel, and its affection for its master often wonderfully supplies the place of teaching,

* Foot note to Goldsmith's "Animated Nature," Brown's edition, vol. ii. p. 207.

and inspires it with a wisdom little short of human. Instances in illustration of this are familiar to the inhabitants of mountainous districts, and the following examples, taken from Brown's Supplement to Goldsmith's Animated Nature, cannot fail to interest the reader:—

"A farmer, near Brechin, having gone, during a severe snow-storm in 1798, to visit his sheep, while employed in driving them from the shelter which they had taken beneath some precipitous rocks, called Ugly-Face, was, with his dog, buried in an avalanche of snow, which fell from these rocks. He was unable to extricate himself, and fell asleep in his desolate situation; but his dog worked his way out, ran to his house, and by significant gestures, procured the assistance of some of the inmates, who, following the dog, were led to the spot where he was overwhelmed with snow. They began to dig, and by nightfall found the farmer in an erect position, quite benumbed, but life not extinguished, and being rolled in warm blankets, he soon recovered.

"About the year 1796, a farmer, at Holling, in Kent, was returning late from Maidstone market, in a state of intoxication. He went astray from the road, about half a mile from Willow-Walk, and becoming completely benumbed, he fell among the snow, in one of the coldest nights ever known. Turning on his back, he was soon overpowered with sleep, in such circumstances the usual concomitant of cold. His dog, that had followed closely after him, now scratched away the snow from about him, so as to form a protecting wall round his person, and then lay down on his master's breast, for which its shaggy coat proved a seasonable protection from the inclemency of the night, and the snow which continued to fall. On the following morning, a person having gone out with the expectation of falling in with some wild fowl, had his notice attracted by the uncommon appearance, and, on coming up, the dog encouraged him, by the most significant gestures to approach. He wiped the icy incrus-

tations from the face of the farmer, whom he then recognized, and had him conveyed to the nearest house in the village, where animation was soon restored."

The last instance which I give of this kind of sagacity, is abridged from the same work, and shows still more remarkable proofs of persevering attachment. Eric Runtson, an Iceland fisherman, left his home early on a December morning, to visit a friend, accompanied only by his faithful dog, Castor. When he had proceeded about five miles, he fell into a deep chasm, and alighted, unhurt, on a shelving part of the rock, about sixty feet below the surface. Castor ran about in all directions, howling piteously. He even several times made as if he would leap down, but was prevented by his master scolding him. He then whined, and looked from the brink into the chasm, as if anxious to receive his master's commands. After spending the whole day in fruitless endeavours to reach and extricate his master, a sudden thought seemed to seize him, and he darted off in the direction of home, which he reached about eleven o'clock. The inmates were asleep, but, by scratching violently at the door, he gained admittance. At first, the family apprehended nothing, but that he had left his master, and returned; but, by his refusing food, and constantly continuing to scratch Eric's younger brother, Jon, with his paw, and then to run to the door, and look back with eager and anxious yells, he at last succeeded in exciting their alarm; and, when Jon and another man dressed and followed him, he began to bark and caper about with evident joy. At one time, the tempestuous weather led them to think of retracing their steps; but Castor, on their turning back, expressed the utmost dissatisfaction, and, by pulling them by the clothes, induced them to proceed. He conducted them to the chasm where poor Eric was entombed, and, beginning to scratch, signified, by the most expressive howl, that his master was below. Eric answered to Jon's call; and, a rope being procured, he was safely drawn up, when Castor rushed to his master, and received his caresses with all the marks of external triumph and joy.

Sir Walter Scott, in a poem written on a traveller who, some years ago, was killed by falling over a precipice on Helvellyn, and whose faithful dog watched many days by his lifeless corpse, thus feelingly describes the attachment of that interesting animal:—

"Dark green was that spot 'mid the brown mountain heather,
Where the pilgrim of Nature lay stretched in decay,
Like the corpse of an outcast abandoned to weather,
Till the mountain winds wasted the tenantless clay:—
Nor yet quite deserted, though lonely extended,
For faithful in death his dumb favourite attended,
The much loved remains of her master defended,
And chased the hill-fox and the raven away.

"How long didst thou think that his silence was slumber?
When the wind waved his garments how oft did'st thou start?
How many long days and long nights did'st thou number?
Ere he faded before thee, the friend of thy heart!
Say, oh! was it meet that, no requiem read o'er him,
No mother to weep, and no friend to deplore him,
And thou, little guardian, alone stretched before him,
Unhonour'd, the pilgrim from life should depart."

The more we know of this wonderful species, the greater reason shall we find to praise that beneficent Being, who gave the dog to man as his companion and friend, and the greater indignation shall we feel against the worse than brutal human beings, who, abusing the devotion of this most affectionate and docile creature, give to their half human attendants no return of kindness; but treat them with cruelty, and recompense their good offices with blows.

TWELFTH WEEK—SATURDAY.

I. GEOLOGY.—ITS PHENOMENA CONSISTENT WITH THE MOSAIC ACCOUNT OF THE CREATION.

THE existence of mountains, which, in the volume on Spring, will be shown to be a most beneficent arrangement, modern geology has proved to be owing to a general disruption of the original crust of the earth. On its first formation, the surface of our globe must have been a plain, or, at least, very nearly approaching to it. The rocks and minerals of which it is now composed, are, on good grounds, believed to have been originally in a liquid state; and, whether fire or water were the agents employed, or if, what is more probable, *both* of them were employed either separately or together, the strata of the earth must, by the law of gravitation, have been formed horizontally, and the surface must then have been level. This introduces us to a most curious and interesting subject; and I intend to devote a few papers to a rapid view of the discoveries of the geologist; but before entering on this alluring field, it seems proper to advert to the attack which has been made by infidel writers on the Mosaic account of the creation; that this matter being put on its proper footing, we may be enabled to proceed with safety and freedom.

These writers allege, that there are incontrovertible proofs of the existence of the world before the era assigned to the Mosaic creation; and that all geological appearances concur in bearing evidence, that many existences, both organized and unorganized, instead of being created in six days, have been successively produced and remodelled in the course of many hundreds, perhaps thousands, of ages.

Now, granting all this to be distinctly established,—for I do not think it necessary to dispute the general view thus stated, much less am I inclined to call in question the facts by which it is supported,—there are

two ways by which these appearances have been attempted to be reconciled to the Mosaic account. The first, and ordinary way is, by supposing that the six days, mentioned by Moses as the period in which Creative power was exerted, may be interpreted to mean so many ages of indefinite extent: And in support of this opinion there are not wanting plausible arguments. The word *day* is assuredly often taken in Scripture to signify an age or an era; thus, we read of "an acceptable day," and "a day of vengeance," and, still more distinctly, of "the latter day," "the day of judgment," and "the day of salvation," all which expressions are evidently meant to indicate, not a natural day of twenty-four hours, but a peculiar period in the actings of God's providence. Again, it has been argued, that the various works assigned to each day, when taken for an era, correspond, with wonderful exactness, to the geological indications; the chaos, when all the elements were in a mixed and turbid state; the separation of the principle of light; the subsidence of the waters, and the appearance of dry ground; the creation of the vegetable kingdom; then of the inhabitants of the sea; then of the inhabitants of the land; and, last of all, of man,—seem to follow in the precise order of succession which the various periods marked by the labours of the geologist appear very clearly to sanction. All this might appear to be satisfactory, were it not that the sacred writer seems anxiously to preclude the possibility of such an explanation, by ending the account of each day's operation in these words, "And the evening and the morning were the first—(the second, the third, &c.)—day," a mode of expression which seems very emphatically to confine the duration of the work, in each instance, to a natural day, or a revolution of the earth on its axis, although this, doubtless, may then have been much more tardy than it is at present.

This method of getting quit of the difficulty, seeming, therefore, to be untenable, we are bound to receive the Mosaic account of the creation in the natural and un-

strained sense of the words, as an inspired, and therefore true representation of the succession of visible appearances on each of the six days of this first week of time, as connected with the system in which man was brought into existence; but the inquiry is still open,—whether or not the materials, of which our present world is composed, might have been made use of by the Eternal Creator, at a period, or during a succession of periods, previous to that of the creation recorded by Moses.

In looking at the account contained in the first chapter of Genesis, with this inquiry in our minds, what do we see? First of all we have an affirmation, in general terms, that God is the Creator of all things: for, I think it will be readily conceded, that nothing more than this is meant by the expression, "In the beginning God created the heavens and the earth." Then follows a declaration, that immediately before the commencement of the Mosaic creation, the materials of which the new world was to be composed were already in existence, but in a chaotic state, "The earth was without form and void, and darkness was upon the face of the deep." Nothing is said of the preceding state of this chaos; because the business of the sacred historian lay entirely with the world as it now exists; but, undoubtedly, there is here no assertion which precludes the previous use of the materials, on which the Almighty was now beginning to operate; on the contrary, the very existence of these materials, if it does not imply, at least renders plausible, the supposition, that they may at some still earlier period have been employed in some other manifestations of the Divine perfections.

Now, if we are permitted to take this view, all the objections of the geologist, arising from the appearances which indicate the existence of organized and living beings long before the era of man, vanish at once. Should it be found, that for many thousands, or even millions of years, the matter of the earth was in existence before the creation of the human race, and that it had been made use of by Him whose being is from eternity, as

the habitation of other modes of vegetable and animal life, in many successive epochs, and with a constant progression towards higher powers and more perfect forms, such facts, so far from invalidating the Mosaic account, seem perfectly consistent with the analogy of revealed religion, which is itself progressive, and the belief of them is even favoured by the manner in which the account of what must then be considered as the *latest* creation, is introduced.

This is the view, then, which I am disposed to take, though I am quite aware that some highly ingenious attempts have been made to reconcile all geological appearances, to the opinion, that the materials of the world did not exist previous to the Mosaic account,—the soundness of which I am not disposed at present to dispute. In any case, the evidence of Scripture, which rests on separate grounds, and is unimpeachable, must be received as paramount. Let every human system, however plausible, perish, which contradicts the word of eternal truth. *Magna est veritas et prævalebit.**

* After this and the succeeding papers on Geology were written, and while the first edition of this work was going through the press, Dr Buckland published his highly interesting and valuable Bridgewater Treatise. It is a great satisfaction to me to observe that this intelligent author has adopted the same view with myself as to the mode of reconciling the Mosaic account with the discoveries of Geology,—a view which he states himself to have long entertained, and to have previously given to the world in his Inaugural Lecture, in 1820. He also quotes some other authors as agreeing with him in this method of reconciliation, such as Dr Chalmers, Bishop Gleig, a writer in the Christian Observer, &c. My own opinion, which was formed independently of these writers, I can now advance with greater confidence. Dr Buckland enters into some details of the six days of creation, supported by critical notices on the Hebrew text, by the Regius Professor of Hebrew in Oxford (Pusey), which are very satisfactory. It is shown that the Hebrew word (*bara*) which we translate "created," does not necessarily signify *formed out of nothing*, though it is a stronger word than *asah*, made: and, it is also stated, that when in the fourth commandment it is declared, that "in six days the Lord made heaven and earth, the sea, and all that in them is;" the word employed is not *bara*, but *asah*, from which it expresses nothing more than "a new arrangement of materials which existed before." Indeed, if we are strictly to interpret the word "create," as signifying made out of nothing, it cannot apply to the work of any of the six days, which consisted in the act of forming out of materials already in existence.

THIRTEENTH WEEK—SUNDAY.

ON THE DIFFICULTY OF COMPREHENDING THE OPERATIONS OF PROVIDENCE.

We have been contemplating the perfections of the Creator, as exhibited in His works. Let us pause a little on this day, set apart for devotional exercises, and turn to the consideration of the same perfections, as exhibited in His moral government.

One of the first things that strikes the mind in adverting to this subject, is the difficulty of comprehending God's dealings with His rational creatures. We immediately discover, that "His ways are not as our ways, nor his thoughts as our thoughts." A peculiar mystery hangs over his operations, when we examine them by the unassisted light of reason; and this mystery is greatly modified, although it is not altogether removed, when revelation adds its clearer light. This every inquiring mind must have felt, in considering the various questions connected with the existence of moral evil. Let us look, then, at the sources of this mystery, and we shall find them all resolving themselves into this one fact,—The infinite transcendency of the Divine perfections.

The wise and good among men frequently act on principles which are not obvious to their inferiors, who are not capable of entering into their exalted views. Can it be matter of surprise, then, that the feeble and grovelling race of Adam should be found incapable of entering into the councils of Him who is infinitely wise, and infinitely good? As in His own nature He is incomprehensible, so in the operations of His providence He may be, and, indeed, He frequently must be, influenced by motives far above our conception. "As the heavens are higher than the earth, so are His ways higher than our ways, and His thoughts than our thoughts." He acts from the

infinite, eternal, and unchangeable impulse of His own mind. The highest angels are infinitely beneath Him. Even they cannot fathom the depth of His councils. No wonder, then, that we should often be confounded in our attempts to scan His character, and comprehend His views.

We shall be better able to understand the extent of the difficulty, if we enter into particulars, and consider some of the ways in which the providence of God operates on His rational creatures. God is omniscient. He knows our frame, and "understands our thoughts afar off." He forms no superficial or unjust judgment of our character and motives, as we short-sighted mortals do in regard to our fellow men. He knows, for instance, whether our actions proceed from selfish or benevolent motives; whether a sense of duty or a love of human approbation lies at the bottom of our conduct;—whether worldly possessions improve or corrupt our hearts. He, therefore, knows, what we cannot distinctly know,—the kind of discipline we require to train us for heaven; and He accommodates the operations of His providence to this knowledge. He comforts us with hope, or encourages us with success, or blesses us with enjoyment, and causes His "candle to shine on our head," just to the extent to which He sees these earthly blessings will be really useful to us. And, on the other hand, He mortifies us with disappointment, or humbles us with disgrace, or chastens us with poverty, or warns us by sickness, or causes the loss of all that was nearest and dearest to our hearts,—that He may thus call us to serious reflection, and break the ties which bind us to the earth, and lead us to place our treasure, and fix our affections, in heaven. And all this He frequently does, without our being able to understand His reasons, because we are ignorant both of our own character and wants, and of the character and wants of others.

Nor is this all. God is acquainted with the ultimate consequences of all events. He traces every thing to its

most remote effects. It is not merely the advantage of a day, or a month, or a year, that He regards. He looks forward to the most distant futurity, and, with unerring certainty, calculates the precise bearing of every present event on ages yet to come. It is an awful consideration, that there is not an action of our lives, nor a word which we utter, nor even a thought which passes through our hearts, that may not be pregnant with important consequences,—with consequences which may not only deeply affect ourselves, but others; which may be productive of good or evil, not merely in our own immediate circle, but, sometimes, even to the community among whom we dwell, and the age in which we live. Nor does the influence necessarily stop here,—it may extend to distant posterity. These consequences *we* cannot see, but God estimates them all. Every word, every look of ours, the all-seeing Eye follows through all its effects on the character of our children, and friends, and neighbours; and thence, again, on the sentiments and conduct of others influenced by them; and, further still, on those of their children, and their children's children, to the latest generations. How infinitely is this beyond the grasp of the human mind!

Again, the Eternal not only knows the effects, but the relations and comparative value of all things. Men view events under a perverted aspect,—judging of their importance more by their nearness or their distance, than by their intrinsic worth. Through the false medium of passion or of prejudice, we are apt to magnify or contract the dimensions of objects, and to form an opinion of them altogether different from the reality. We shall be more sensible of this, if we reflect, for a moment, on the different sentiments with which we regard death, when we hope that this event is distant, and when we perceive or imagine it to be near; or, indeed, if we consider the general tendency of the mind to form a foolish attachment to temporal things, in preference to those things that are eternal.

But none of these prejudices and prepossessions obstruct or deceive the vision of the Almighty. Those things which occupy the attention of our worldly minds, He sees in all their emptiness and frivolity; the heavenly treasures which we regard with such indifference, He views in their infinite magnitude and importance; and all these, with unerring wisdom, He adjusts (independent of the vain wishes of men), so as to promote the greatest good. Here is another obvious source of inadequate comprehension on our part.

We must further remember, that these unsearchable operations are not confined to the welfare of individuals. They embrace the interests of nations,—of the earth,—of the universe! While there is not a living being in creation to whom the paternal care of the Creator does not extend, He views the world as a whole, and so regulates every part, as either to promote the happiness of all, or to visit them with retributive justice. What a wonderful conception is this! From the worm to man, from man to the archangel, all are linked together in the councils of God; and, while there is not one of all these creatures whom He does not care for, as if there were no other being to occupy his attention, all are governed as one great family, of which each member has its own department, and in which one great design is constantly kept in view,—the perfection and happiness of the whole.

Nor must we forget, that the schemes of the Self-existent are not bounded by time, but embrace eternity. In the present world, the moral government of God is only begun. That may appear imperfect and disordered, of which we only see a part, when, if the whole were displayed and understood, every minute particular, and the united result of the whole, would be found to be the perfection of wisdom.

He who has seen a powerful and complicated system of machinery in operation, of which he was only permitted to examine a small part, may form some idea of

the effect of so partial a view of the operations of Providence. He saw an apparently confused and unwieldy mechanism, of which he neither understood the principle nor the use. Wheels on wheels, moving in seeming disorder,—valves opening and shutting,—levers straining,—beams revolving,—while fire and water combined their mysterious powers. He perceived, in short, an immense expense of labour and ingenuity,—and all for what? He could not tell: He observed amazing powers in operation; he heard a grating and astounding noise,—and that was all. But were he admitted into the upper apartments, where the effect of all these operations is displayed, what a different opinion would he form? How would he admire the talents which could so control the powers of nature, as to give man a force immensely superior to his own, and add to the resources, and ensure the prosperity, not of individuals only, but of the whole empire!

And so it is with the operations of Providence. Here we see but a part, and that a very small part, of the machinery by which He conducts the moral government of the world. Even if we could understand all the relations of temporal things, we could not understand their bearings on eternity. Some glimpses, indeed, Revelation has afforded us into that upper apartment, where the whole scheme is consummated, and where the ways of God are vindicated to his creatures; but how imperfect and how inadequate! Let us look forward with eagerness and hope to the approaching period, when the veil shall be removed from our eyes, and "we shall know even as we are known."

THIRTEENTH WEEK—MONDAY.

II. GEOLOGY.—SUCCESSIVE PERIODS OF DEPOSIT.

Assuming the existence of matter from an indefinite period before the commencement of the Mosaic creation, let us attend to the opinions which have been adopted by modern geologists, from views founded on the knowledge they have acquired of the crust of the earth.

It should seem, according to these inquiries, that there are three well marked periods in the primitive history of our globe, during which the most extensive changes have taken place on its surface, and fresh deposits have been made. The order of time in which these changes have been effected, can be fixed, as is supposed, with considerable precision. We are first informed, that there was what may be called the primitive era, or period of granite, when this species of rock, with other stony substances, and the wide-spread ocean from which, in the process of ages, extensive deposits of sand were made, seem to have covered the whole face of the earth, forming a cheerless and gloomy waste, destitute of organized existences, and void of life. This epoch is said to have been followed by another period of long duration, in which some violent convulsions have taken place, and active powers have been at work, effecting extensive changes, without appearing, during its continuance, to have settled down into a permanent state; hence called the transition period. It is during this period, that the first rudiments of vegetable and animal existences seem to have taken their origin, as the lowest kind of organized beings are found embedded in its deposits.

"Beginning with the animal kingdom," says Dr Buckland, "we find the four great existing divisions of *Vertebrata*, *Mollusca*, *Articulata*, and *Radiata*, to have been coeval with the commencement of organic life upon our

globe. No higher condition of Vertebrata has yet been discovered in the transition formation than that of fishes." "The Mollusca, in the transition series, afford examples of several families, and many genera, which seem at that time to have been universally diffused over all parts of the world." "The earliest examples of Articulated animals are those afforded by the extinct family of Trilobites." These seem to have perished at the end of this series. "The Radiated animals are among the most frequent organic remains in the transition strata. They present numerous forms of great beauty." Of the vegetable kingdom in this earliest period of organized existences, Dr Buckland says, "In the inferior regions of this series, plants are few in number, and principally marine; but in its inferior regions, the remains of land plants are accumulated in prodigious quantities." They form, in their destruction, a great part of our present coal fields, and many strata of the carboniferous order contain subordinate beds of a rich argillaceous iron ore. "A formation," adds our author, "that is at once the vehicle of two such valuable mineral productions as coal and iron, assumes a place of the first importance among the sources of benefit to mankind; and this benefit is the direct result of physical changes which affected the earth at those remote periods of time, when the first forms of vegetable life appeared upon its surface."

Resting on the transition rocks, and therefore believed immediately to succeed them in the era of their deposition, come the rocks of what has been called the secondary epoch, during which, along with a distinct and peculiar vegetation, animals have existed, chiefly the inhabitants of the waters, or saurian reptiles, of gigantic forms, partly marine, partly amphibious, and partly terrestrial; and, at the same period also, have lived mammalia of the marsupial order, and some testudinata and feathered tribes; as, not only their petrified remains, but, what is still more remarkable, the marks of their footsteps on sandstone have recently been found to testify. Dr

Buckland, in speaking of fossil Testudinata, says, "The remains of land tortoises have been more rarely observed in a fossil state. Cuvier mentions but two examples, and these in very recent formations, at Aix, and in the Isle of France. Scotland has recently afforded evidence of the existence of more than one species of these terrestrial reptiles, during the period of the new red or variegated sandstone formation. The nature of this evidence is almost unique in the history of organic remains." In a foot note he states that a discovery of fossil footmarks, similar to that made at Corncocklemuir, which was communicated by me in 1828, to the Edinburgh Royal Society, has recently been made in Saxony, at the village of Hessberg, near Hildburghausen, in several quarries of grey quartzose sandstone, alternating with beds of red sandstone, nearly of the same age with that of Dumfriesshire, of which notices have been given by Dr Hohnbaum, Professor Caup, and Dr Sickler. In another place he also mentions foot-marks of several extinct species of birds, having very lately been found by Professor Hitchcock, in the new red sandstone of the Valley of Connecticut, one of them of a species of enormous dimensions, which took a stride of six feet. On the subject of these discoveries, with particular allusion to that in Corncocklemuir, Dr Buckland has the following elegant observations:—"The historian or the antiquary may have traversed the fields of ancient or of modern battles, and may have pursued the line of march of triumphant conquerors, whose armies trampled down the most mighty kingdoms of the world. The winds and storms have utterly obliterated the ephemeral impressions of their course. Not a track remains of a single foot or a single hoof, of all the countless millions of men and beasts, whose progress spread desolation over the earth. But the reptiles that crawled upon the half-finished surface of our infant planet, have left memorials of their passage enduring and indelible. No history has recorded their creation or destruction; their very

bones are found no more among the fossil relics of a former world. Centuries and thousands of years may have rolled away, between the time in which these footsteps were impressed by tortoises upon the sands of their native Scotland, and the hour when they are again laid bare, and exposed to our curious and admiring eyes. Yet we behold them stamped upon the rock, distinct as the track of the passing animal upon the recent snow; as if to show that thousands of years are but as nothing amidst eternity;—and, as it were, in mockery of the fleeting perishable course of the mightiest potentates among mankind."

To the secondary period, again, is believed to have succeeded another epoch, during which rocks, of what is called the tertiary formation, have been deposited, and animals, as well as plants, of a larger and more perfect kind, and approaching nearer to those of our own era, have existed.

The Tertiary epoch has recently been divided into four periods, founded on the proportions which their fossil shells bear to marine shells of existing species. During the first period, these productions exhibit but a small resemblance to our present orders, but this resemblance increases through each successive period, till the greater proportion of the fossil species come to bear a distinctly marked affinity to present existences. A similar remark may be made with regard to the inhabitants of the land. By far the greater proportion of the genera which existed during the earliest period of this epoch, are now extinct, while the terrestrial animals of the latest period have very generally antitypes in the living species of our own era. "It appears," says Dr Buckland, "that at this epoch the whole surface of Europe was densely peopled by various orders of Mammalia, that the numbers of the *herbivora* were maintained in due proportion by the controlling influence of *carnivora*; and that the individuals of every species were constructed in a manner fitting each to its own enjoyment of the pleasures of existence, and placing it in due and useful relations to the animal and vegetable kingdoms by which it was surrounded." He then concludes his observations on the tertiary series with the following just and striking remarks:—"Every comparative anatomist is familiar with the beautiful examples of mechanical contrivance and compensations which adapt existing species of *herbivora* and *carnivora*, to their own peculiar place and state of life. Such contrivances began not with living species. The geologist demonstrates their prior existence in the extinct forms of the same genera, which he discovers beneath the surface of the earth; and he claims for the Author of these fossil forms, under which the first types of such mechanisms were embodied, the same high attributes of wisdom and goodness, the demonstration of which exalts and sanctifies the labours of science, in her investigations of the organizations of the living world."

This latter period is believed to have immediately preceded the Mosaic creation, and to have ended in some universal catastrophe, which entirely broke up and deranged the whole face of the earth, destroying all vegetable and animal life, and reducing the whole materials of the globe to that state of chaos which the sacred historian so briefly, but emphatically describes, when he says, that "the earth was without form and void, and darkness was on the face of the deep."

It would be inconsistent with my plan to enter, with any minuteness, into a detail of the arguments by which geologists maintain the truth of these views; but I may mention, in a single sentence, that the rocks called primary, obtain this name, because, though they frequently are found to have burst through all the other strata of which the crust of the earth is composed, and even to overtop them all, forming our most elevated mountain ranges, yet they uniformly dip deeper down below the earth's surface than all the rest, and form the substratum on which the others recline. Immediately above these,

lies the transition deposit, then the secondary, and then the tertiary formations. The obvious conclusion is, that, if we may at all suppose successive periods of deposit, these periods must have occurred in the order we have described; and the existence of peculiar forms of organized beings, connected respectively with these periods, while it strangely excites curiosity, and gives a very deep and mysterious interest to the subject, by opening up, as it were, a glimpse into former worlds, cannot readily be accounted for in any other way than by the hypothesis of successive epochs and successive creations. If, indeed, the plants and animals of one formation were found intermingled with those of another, there might be some ground for hesitation. But this is not the case; and, what is particularly worthy of remark, it appears that the whole individuals of the organized beings, which existed during those primeval periods, had been destroyed before the era of the Mosaic creation, none of such species being in existence at the present day.

What a surprising, and at the same time consistent, view does this open up, of the operations of the Eternal Mind. We have been accustomed to think of the Self-existent Being as only beginning to exert his creative energies, within the last six thousand years, when our globe was brought out of a state of chaos, and the human race was formed. But it is natural for the inquiring mind to ask, if it be indeed true that an eternity had passed before the Almighty displayed his perfections, by calling worlds into existence, and exercising over them that paternal care which is so conspicuous and so endearing in the present state of things. This inquiry we may not be able satisfactorily to answer; but it is undoubtedly a step towards the solution of the question, to discover, that the materials of which the present earth is composed, have been employed by the Creator, in previous periods of unknown but vast duration, in the formation of other worlds, of which other beings, strangers to the existing earth, were denizens; and we seem to acquire a more

sublime idea of the Divine perfections, when we think of those primeval times, "in which plants and flowers, now totally unknown, adorned the face of nature, and rose to luxuriance under warmer suns; in which animals of different forms and species, roamed the woods and forests; and in which the ocean rolled its billows, and the finny tribes found food and enjoyment, where now fertile fields wave with grain, and the lofty trees of the forest throw their boughs towards heaven, and man and beast tread the solid ground."*

THIRTEENTH WEEK—TUESDAY.

III. GEOLOGY.—SUCCESSIVE PERIODS OF ORGANIZED EXISTENCES.

If the view of our modern geologists, which I have adopted, be correct, there is something exceedingly interesting, and certainly, as I have already observed, not inconsistent with the character of the Creator, as we read it inscribed on His works, in the gradual development of the powers of nature, and in the adaptation of living beings to the progress of that development. "In the beginning," the earth was, according to this hypothesis, created a mass of inert matter, perhaps in a liquid state from excessive heat, but crystallizing as it cooled, till the whole crust of the globe was comprised in the two great divisions of sea and crystallized rocks, surrounded with an atmosphere. This was its primitive state; and under these circumstances, neither vegetables nor animals could exist; but, being intended for the habitation of living beings, the powers inherent in matter were employed in breaking down, abrading, and disuniting the harder substances, so as to form soil fit for the maintenance of vegetable produce; and thus, in process of

* Study of Nature, p. 202.

time, it passed into the transition state. No sooner was the globe, to this extent, prepared, than vegetables were created by the Almighty hand; and food being thus produced for living creatures, these also were called into being, with faculties and endowments admirably fitted for the earth, as it then was. Still the process of decomposition and crumbling down went on, till the world became fitted for a new change. A catastrophe, therefore, took place, by which all organized existences were destroyed and submerged; and, by a most wonderful provision, these were laid up in storehouses, as it were, below the surface, for the future use of the rational creatures which were, in the succession of ages, to be created, being meanwhile, by pressure and disintegration converted, the marine productions into lime, and the produce of the land into coal. And now a new operation of creative wisdom takes place. More nourishing qualities have been infused into the waters of the sea, and the surface of the earth has acquired more fertile powers, by which the whole globe is fitted for the maintenance of higher species of plants and animals. They are accordingly produced. A more noble and luxuriant vegetation clothes the face of the earth. Living creatures of gigantic proportions swim in the ocean, or frequent the vast swamps and marshes which compose its shores, or feed among the mighty palms and ferns which spring up on the elevated grounds. But the wonderful plan formed in the Eternal Mind is not yet completed. Another period elapses, in which further changes have been going on, and continued preparations have been making. At length new epochs arrive, and new catastrophes take place. Again and again the surface of the globe is broken up; its vegetable and animal productions are again and again entombed, to add to the stores of the higher race destined to appear in a new era and a renovated world.

Last of all, the time arrives, when the globe is fitted for a race of rational creatures. "The earth is without

form and void." The elements are commixed; and thickest darkness broods over the profound abyss. God speaks; it is light, and the clouds ascend. He speaks again; the solid foundations of the world are disturbed; an irresistible force heaves the ancient granite from its bed, causing it to shake off the superincumbent strata which ages had formed, and to throw aloft its rugged peaks, till they threaten to penetrate the sky. The waters subside, and are gathered together. An effectual separation is thus made between the seas and the dry land, and a new character is given to the earth's surface, which fits it for its coming destiny.* Once more the Creator utters his voice. "The earth brings forth grass, the herb yielding seed, and the fruit-tree yielding fruit." Yet again the command is issued, and the clearing atmosphere gives free admittance to the direct rays of the sun, moon, and stars.† Thus is the world once more prepared as the

* "It is marvellous that mankind should have gone on for so many centuries in ignorance of the fact, which is now so fully demonstrated, that no small part of the present surface of the earth is derived from the remains of animals, that constituted the population of the ancient seas. Many extensive plains and massive mountains form, as it were, the great charnel-houses of preceding generations, in which the petrified exuviæ of extinct races of animals and vegetables are piled into stupendous monuments of the operations of life and death, during almost immeasurable periods of past time." "'At the sight of a spectacle,' says Cuvier, 'so imposing, so terrible as that of the wreck of animal life forming almost the entire soil on which we tread, it is difficult to restrain the imagination from hazarding some conjectures as to the causes by which such great effects have been produced.'"—*Buckland's Bridgewater Treatise*, p. 112.

† Speaking of the 14th, and four succeeding verses of the first chapter of Genesis, Dr Buckland, in agreement with what is stated in the text, thus argues:—"What is herein stated of the celestial luminaries, seems to be spoken solely with reference to our planet, and more especially to the human race, then about to be placed upon it. We are not told that the *substance* of the sun and moon were first called into existence upon the fourth day. The text may equally imply that these bodies were then prepared, and appointed to certain offices of high importance to mankind: 'to give light upon the earth, and to rule over the day, and over the night;' 'to be for signs, and for seasons, and for days, and for years.' The fact of the creation had been stated before in the first verse. The stars also are mentioned (Gen. i. 16.), in three words only, almost parenthetically, as if for the sole purpose of announcing that they also were made by the same Power as those luminaries which are more important to us—the sun and the moon. The interpretation here proposed seems, moreover, to solve the

residence of living beings; and *they* are created. The broad spread sea and swelling earth teem with animation; and, last of all, Man is formed in the image of God. His Creator "breathes into his nostrils the breath of life, and he becomes a living soul;"—the lord of this nether sphere stands confessed.

Such is the progress which, according to modern geology, corrected by the lights of Scripture, has formed the earliest history of creation. The system, perhaps, deserves no higher name than that of a theory; but it is a beautiful and consistent theory, which accounts for many facts, and is contradicted, so far as I know, by none. It is exceedingly gratifying to human genius to have thus found the means of penetrating beyond the darkness of ancient chaos, and the confusion of mingled elements; and it is not less instructive than gratifying, to be able to trace, even in these mysterious primeval times, the designing hand of Infinite Wisdom and Goodness; to see the very same character impressed on the works of the Creator, in such incalculably remote periods, which we mark with so much delight in the history of the world, since that latest epoch, in which the human race was formed, the chief of His terrestrial works; and in which subordinate organized beings, in a scale descending by almost imperceptible links, till they become confounded with inanimate matter, were associated with them.

One objection I anticipate. Why, it may naturally be asked, this progression and long delay? Why was

difficulty which would otherwise attend the statement of the appearance of light on the first day, while the sun and moon and stars were not made to appear until the fourth. If we suppose all the heavenly bodies and the earth to have been created at the indefinitely distant time designated by the word 'beginning,' and that the darkness described on the evening of the first day, was a temporary darkness, produced by an accumulation of dense vapours 'upon the face of the deep,' an incipient dispersion of these vapours may have readmitted light to the earth, upon the first day, while the exciting cause of light was still obscured; and the further purification of the atmosphere, upon the fourth day, may have caused the sun and moon and stars to reappear in the firmament of heaven, to assume their new relations to the newly modified earth, and to the human race."

that Infinite Power not put forth at once, which was to form the world in its highest state of perfection? Could not the same Almighty power, which, according to this theory, formed the earth an inert mass, and left the development of its productive qualities to a succession of ages, have called it into being, in all its glory, by a single word? Undoubtedly it could; and the reason of a different mode of operation may be inscrutable by the human mind. But who does not see that such progression is in accordance with the usual analogy of the Divine operations; and that the very same objection might be urged against the progress of society in the arts and in civilization; against the gradual unfolding of the eternal decrees in the history of revealed religion; against the slow growth of an oak; or against the tardy expansion of the human powers through the various stages of infancy, youth, and manhood. Time is, even with man, but a relative term. In the counsels of Him, with whom "a thousand years are but as one day," it dwindles to a point.

THIRTEENTH WEEK—WEDNESDAY.

IV. GEOLOGY.—STATE OF THE ANTEDILUVIAN WORLD.

The arrangements on the surface of the earth, in its antediluvian state, were, doubtless, in many respects, different from what they are at present. I do not allude to its state as it came first from the hands of its Creator, when all things bore the recent impress of a Divine hand, when Paradise bloomed, and the gentle air breathed balm, and, on the young vegetable and animal world, the blessing of a benignant Heaven shed peace, grandeur, and loveliness; but I speak of it after the blight of an

alienated Deity had fitted it for the habitation of a fallen and guilty race, who were to earn their subsistence amidst toil and care, strangers and pilgrims on their native earth, and under training, by a course of discipline, for new states of existence in another sphere.

Of the actual condition of the antediluvian world, we have scarcely any recorded materials from which we can draw correct geological conclusions. We are informed, however, that the life of man extended to a period of tenfold greater duration than it does at present, which indicates a much greater salubrity of the atmosphere; and it is remarkable, that the organic remains of that first period of the human history, correspond with this indication. The state of the air and of the seasons, which was so healthful for man, may readily be supposed to have been equally favourable to the nourishment of other organized existences; and if we are to look for proofs from geology to confirm the assertion of the sacred volume on this point, we must seek for it in a greater luxuriance in the growth of plants and animals. Man himself, who seems not to have arrived at the period of puberty before sixty or seventy years of age, was probably of superior stature,—a conjecture which is confirmed by the existence of giants, as we are expressly assured, both before the flood, and for some time after it. However this may be, it is remarkable, that we have undoubted proofs, from antediluvian remains, that many of the organized existences of that period were of much greater dimensions than are now to be found, either in the vegetable or animal kingdoms. Tropical plants seem to have spread over our temperate regions in great luxuriance of vegetation, and among animals there are found, in these regions, some of immense proportions, whose species are now extinct, or, if still existing, as in the case of the tapir, are greatly diminished in size. From these facts, we have evidence that the antediluvian climate was peculiarly genial, and therefore we need not be surprised to find that it was far more favourable to

human life, than the mingled and polluted atmosphere in which we at present exist.*

In another respect, too, the aspect of the antediluvian world must have been considerably different from its present state. Since that early period, a deluge has swept over its surface with tremendous force, levelling hills, filling up valleys, scooping out ravines, altering the bed of the ocean, and blotting out, perhaps, whole continents from the map of the world, while it raised others in their place. By the action of this great catastrophe, very large additions must have been made to

* In this view of the superior salubrity of the antediluvian climate, the author is directly opposed to the speculations of Bishop Sherlock, who imagines that the curse pronounced on the ground rested upon it "in all its rigour," only till the flood, up to which period it rendered the work and toil necessary to raise from the ground a sufficient support for life, a grievous and irksome burden;" but that, after this catastrophe, that part of the curse which referred to the soil was removed, and the world was, in this respect, restored to its primeval beauty and fertility. This strange notion rests for its support on two texts of Scripture, the first of which is the reason given by Lamech for naming his first born son Noah, which means *comfort*, viz. "This same shall *comfort* us concerning our work and toil of our hands, because of the ground which the Lord hath cursed," (Gen. v. 29). Those who have noted the custom which prevailed from the earliest times, of recording a reason for the naming of children at or soon after their birth, will scarcely see in this passage any thing more than the delight and pious gratitude of a father, for the gift of a son who should assist him in his agricultural labours. The Bible is full of similar birth-day sayings; thus Eve called her first-born son Cain, which signifies *gotten*, for she said, "I have gotten a man from the Lord;" and when, after the murder of Abel, she had another son, she called him Seth, which signifies *appointed*. "For God," said she, "hath *appointed* me another seed, instead of Abel, whom Cain slew." Many other instances might be mentioned.

The other text on which Sherlock builds his theory, can scarcely be considered of greater weight. It is the promise contained in the two last verses of the eighth chapter of Genesis. "I will not again curse the ground any more for man's sake, neither will I again smite any more every thing living as I have done. While the earth remaineth, seed-time and harvest, and cold and heat, and summer and winter, and day and night, shall not cease." The Bishop argues that these words intimate the removal of the curse, and the restoration of a greater stability of the seasons; but surely this is an unwarranted stretch of the meaning of a text which simply declares that no such calamity as the flood shall ever again visit the earth. The vigour of the human constitution in the antediluvian ages, which is distinctly asserted, is alone sufficient to overturn the Bishop's theory; and the same thing seems to follow from the fact, that the gift of animal food was not added to that of vegetables, till after the flood,—an indication of the superior fertility and abundance, in the earliest ages, of plants fit for human subsistence.

the productive soil of the earth, from the effects of detrition; but even then the soil appears to have been abundant, at least in many and extensive portions of the globe; and, whatever changes have been made, of which we shall speak more particularly in another paper, the general character of the terraqueous globe, and its inhabitants, must have been, with the exceptions already hinted at, nearly the same as at present. There was not only an abundant vegetation on its surface, but there were metals (brass and iron) which the labour of man could reach, and his ingenuity could convert to his use. Fire must have been employed in smelting and manufacturing these metals; and, from the slight hints which the sacred historian affords, it would appear, that the domestic arrangements of families could not have greatly differed from our own.

This may suffice as a rapid introduction to the changes which I shall next have occasion to notice—those which were occasioned by the universal deluge. Meanwhile, what a wonderful period have we been surveying!—a new world of organized beings has been created, and has perished. It came fair and perfect from the hands of its Creator. Throughout its whole bounds, there was no evil, no deformity, no death. The eye of the Almighty, as he beheld His work, "saw that it was good." It was created for the happiness of every living creature, and it completely answered the end. Every thing in the complicated machinery of Nature was, with the nicest skill, adjusted to all the rest, so that there was no jarring—no interference. All was peace, and harmony, and joy. But the adversary and destroyer came. By a mysterious providence, he was permitted to prevail. Moral evil was introduced into the rational creation, and a new order of things arose. A state of universal blessedness was converted into a state of human discipline. New adjustments became necessary, and were accomplished. The animal and vegetable world, the earth, the sea, and the air, were all accommodated to this wonderful revolution. Wintry storms desolated the land, and chafed the raging sea; earthquakes shook the solid globe; volcanoes poured forth their liquid fire; lightnings flashed, and thunder rent the sky;—decomposition, decay, and death, became the common law of organized existences;—while man, the guilty author of all this disorder, refusing to learn under the rod, waxed only more and more rebellious, till the whole world was filled with violence, and the measure of his iniquity being full, the sentence came forth from the Creator,—"Behold! I, even I, do bring a flood of waters upon the earth, to destroy all flesh, wherein is the breath of life, from under the heavens; and every thing that is in the earth shall die." How mysterious was the forbearance which permitted the rebellion, but how just was the judgment which punished it!

THIRTEENTH WEEK—THURSDAY.

V. GEOLOGY.—INDICATIONS OF THE ACTION OF THE DELUGE AT THE PERIOD ASSIGNED TO IT IN SCRIPTURE.

I AM now to consider the geological indications of that universal deluge, by which a new epoch was formed in the history of the world, and by which, while the increasing wickedness of the human race, then existing, was visited by the Divine Governor, with a signal display of His displeasure, a new order of things was prepared.

The account which the sacred historian gives of this awful event, is, that "the fountains of the great deep were broken up, and the windows of heaven were opened, and the rain was upon the earth forty days and forty nights; and the waters prevailed exceedingly upon the earth, and all the high hills which were under the whole heaven were covered; and all flesh died that moved up-

on the earth, both of fowl, and of cattle, and of beast, and of every creeping thing that creepeth upon the earth, and every man; and Noah only remained alive, and they that were with him in the ark. And the waters prevailed upon the earth an hundred and fifty days." It appears further from the Divine record, that, in the sixth month from the commencement of the catastrophe, the waters began to subside; and that, at the end of a year, the seas were collected, or rapidly collecting, into their present channels, and the earth had become so dry, at least in the higher grounds, as to be again fit for the habitation of living creatures.

It has been too justly alleged, that there is a tendency to scepticism in the minds of scientific men; that, whether it be from a pride of understanding, which induces them to look down with contempt on the opinions of the vulgar, or from a consciousness of enlarged ideas, which inclines them to distrust, as contracted or superstitious, the views they have acquired in the nursery and in their elementary schools of instruction, they frequently feel a pleasure in adopting views, and maintaining principles, at variance with revealed truth. At all events, the Mosaic account of the deluge, as well as of the creation, was certainly received with incredulity by those individuals who, about the beginning of the present century, took the lead in geological investigations; and I am by no means sure, that this reproach does not still attach to many who affect the name of philosophical inquirers. Brydone endeavoured to throw doubt on the Scriptural account, by an allegation (which was completely overturned, however, by subsequent discoveries), regarding the time requisite for converting lava into vegetable soil, which would have given an antiquity to the earth's present surface, far beyond the period of the flood; and Bailly used, for the same purpose, and with similar success, the false and vain-glorious chronology of the Hindoos.

Happily, however, a philosopher of a different stamp

has arisen, who, rigidly questioning Nature, without reference to any preconceived opinion, and without regard, I believe, even to the authority of Scripture, has come to the conclusion, that the appearances on the surface of the earth, indicate the origin of its present state, as having taken its date at a period corresponding, with wonderful exactness, to the Mosaic account. The words in which M. Cuvier states this satisfactory opinion, are sufficiently pointed and precise. "I conclude," he observes, "with MM. Deluc and Dolomieu, that, if there be any fact well established in geology, it is this, that the surface of our globe has suffered a great and sudden revolution, the period of which cannot be dated further back than 5000 or 6000 years. This revolution has, on the one hand, engulphed, and caused to disappear, the countries formerly inhabited by men, and the animal species at present best known; and, on the other, has laid bare the bottom of the last ocean, thus converting its channel into the now habitable earth."*

A rapid statement of the principles on which Cuvier founds his reasoning, may suffice to show, that it does not rest on mere theoretical views, but is based on incontrovertible facts.

It is well known, that great and constant changes are

* That the Supreme Being, not only in the ordinary course of His providence, but even when He interferes to execute judgment, generally makes use of second causes, seems to be admitted. In the case of the deluge, He probably did not deviate beyond what is stated in the Sacred Volume, from this usual mode of operation, and human curiosity has led to the inquiry by what natural powers the flood was effected. That there are agents in nature quite sufficient, in point of force and extent, to produce the effects described, cannot be doubted. The most obvious of these is thus stated by Dr Fitton, in his Geological Sketch of the Vicinity of Hastings. "The evidence in proof of great and frequent movements of the land itself, both by protrusion and subsidence, and of the connexion of these movements with the operation of volcanoes, is so various and so strong, derived from so many quarters on the surface of the globe, and every day so much extended by recent inquiry, as almost to demonstrate that these have been the causes by which those great revolutions were effected: and, although the action of the inward forces which protrude the land, has varied greatly in different countries, and at different periods, they are now, and ever have been, incessantly at work in operating present change, and preparing the way for future alteration in the exterior of the globe."—Pp. 85, 86.

going on in the surface of the earth, by the decomposing power of the atmosphere, by the effects of rain and of frost, by the decay of vegetation, by the fall of forests, by the shifting and accumulation of sand drifted with the wind, and by the continual course and occasional overflowing of rivers and mountain torrents. The effects of these agents are indeed slow, but they are constantly progressive. They prove, as I have previously stated, that the present condition of the world has not been eternal, because, in the revolution of countless ages, the earth would, by such means, be necessarily reduced to a level; or rather the whole land, being carried into the sea, would be submerged and overflowed by the water. Now, the rate at which these changes proceed, may be subjected to calculation; and this is what Cuvier has actually effected. He examined the progress of accumulations at the mouth of rivers, at the bottom of lakes, and in valleys; he formed an estimate of the rate at which rocks and mountains crumble, and sand, drifted from the sea, where it is formed, spreads into downs, and encroaches on the vegetable soil; and he considered the amount of detrition which takes place in ravines, and in the bottom and banks of rivers. All these causes of change he investigated with his own characteristic acuteness; and he and his associates, in carrying back their calculations, found that they all united in pointing to a period when they commenced their united operations, which, as he states, "cannot be dated further back than 5000 or 6000 years." In other words, it appears as the result of these investigations, that the present surface of the earth cannot have been more than that number of years in existence. It would seem, from what this philosopher states, when he gives a more specific account of his investigations, that, in naming these round numbers, he carries his concessions to the most extreme verge of possibility; and that his own settled opinion is, that the Mosaic account, which fixes the era of the flood at the distance of little more than 4000 years from the present

time, is borne out with remarkable accuracy. In another part, afterwards quoted, he expressly says,—"Geology apprises us, that, of the various revolutions which have agitated our globe, the last evidently corresponds to the period which is assigned to the deluge;" and he distinctly states 4000 years as the period indicated by the alluvial deposits.

We shall, to-morrow, give an example or two of the manner in which Cuvier conducted his inquiries on this important and most interesting subject.

THIRTEENTH WEEK—FRIDAY.

VI. GEOLOGY.—CUVIER'S CALCULATION RESPECTING THE DELUGE.

It is so desirable to remove sceptical doubts, as to the actual occurrence of the deluge, that we cannot leave this subject without stating a few further geological facts, which show the coincidence of actual observation with the declarations of Scripture. As an example of the manner in which the inquiries respecting the date at which the present surface of the earth was formed, have been conducted by Cuvier, and other geologists who adopt his views, it may be interesting to quote the following passage from that distinguished philosopher's "Theory of the Earth:"—"M. de Raney, a learned member of the Institute, inspector-general of bridges and roads, has communicated to me some observations, which are of the greatest importance, as explaining those changes that have taken place along the shores of the Adriatic. Having been directed by government to investigate the remedies that might be applied to the devastations occasioned by the floods of the Po, he ascertained that this river, since the period that it was shut up by dykes, has so greatly raised the level of its bottom, that

the surface of its waters is now higher than the roofs of the houses in Ferrara. At the same time, its alluvial depositions have advanced so rapidly into the sea, that, by comparing old charts with the present state, the shore is found to have gained more than six thousand fathoms since 1604, giving an average of a hundred and sixty or a hundred and eighty, and, in some places, two hundred feet yearly. The Adige and the Po are, at the present day, higher than the whole tract of land that lies between them; and it is only by opening new channels for them in the low grounds which they have formerly deposited, that the disasters which they now threaten may be averted.

"The same causes have produced the same effects along the branches of the Rhine and the Meuse; and thus the richest districts of Holland have continually the frightful view of their rivers held up by embankments, at a height of from twenty to thirty feet above the level of the land."

We have here a curious example of the kind and amount of detrition by which, in the course of years, the higher grounds are worn down to fill up valleys, and to extend into the sea, and facts of a similar kind are every where familiar to the geological inquirer.

Mr Fairholme, in his "Geology of Scripture," gives a striking account of the manner in which a fresh water lake has been encroached on by the land in the course of a century, which illustrates the same kind of natural action as that above mentioned, on which Cuvier founds his calculations, although, in the instance given, that action was assisted by the interference of art. Speaking of the Kander, a mountain torrent of no great size in the Canton of Berne, he says, that in consequence of the mischief done by the overflowing of that river, to a great extent of valuable meadow land, in its course to join the Arr, ten miles below the Thoun, which was its natural course, a spirited plan was, about the beginning of last century, proposed and adopted for cutting a subterraneous passage for the river through a ridge, at a place where it approached the lake. The descent was rapid, and the torrent in a few years enlarged its course, till at length the whole superstructure gave way and fell in. The effects of this soon became apparent in the lake. An immense quantity of gravel and stones was carried in by the current, and lodged in its bed; and by this means a new formation took place at the mouth of the river, which, in 1829, being little more than a century, had "produced a secondary bed of mixed materials, of fully three hundred acres, and at least one hundred feet in depth."*

This remarkable formation took place under peculiar circumstances; but all rivers are actively employed in effecting similar changes to an extent of which those who have not attended to the subject are little aware. Major Rennel and Major Colebrooke calculate that the waters of the Ganges contain, in the season of flood, one part in four of mud, on which Mr Lyell remarks, "We are somewhat staggered by the results to which we must arrive, if we compare the proportion of mud as given by Rennel, with his computation of the quantity of water discharged, which latter is probably very correct. If it be true that the Ganges, in the flood season, contains one part in four of mud, we shall then be obliged to suppose that there passes down every four days a quantity of mud equal in volume to the water which is discharged in the course of twenty-four hours. If the mud be assumed to be equal to one-half the specific gravity of granite (it would, however, be more), the weight of matter daily carried down in the flood season would be about equal to seventy-four times the weight of the great pyramid of Egypt. Even if it could be proved that the turbid waters of the Ganges contain one part in a *hundred* of mud, which is possible, and which is affirmed to be the case in regard to the Rhine, we should be brought to the extraordinary conclusion; that there passes down, every

* P. 124.

day, into the Bay of Bengal, a mass, more than equal in weight and bulk to the great pyramid."

I quote these examples to show that the process by which the earth encroaches on the sea, and becomes reduced in the elevation of its surface, is in many instances astonishingly rapid; but it is not in these extreme cases that Cuvier founds his calculation, but on an average of ordinary cases. He takes his observations partly from the Deltas of the Nile and the Rhone, and partly from the depositions along the shores of the sea of Asoph, and the Black Sea; and he also considers the growth of peat mosses, the extent of mountain slips, and the progress of downs; and, by collating the results of these diversified operations, he finds them, as I have already intimated, all concurring in one conclusion, which serves by a new test to verify the Scriptural account of the era of the deluge, and its universal operation.

But it may be more satisfactory to give the words of Baron Cuvier himself:—"Thus, while the traditions of all nations have preserved the remembrance of a great catastrophe, the *deluge*, which changed the earth's surface, and destroyed nearly the whole of the human species, geology apprises us, that, of the various revolutions which have agitated our globe, the last evidently corresponds to the period which is assigned to the deluge. We say, that by means of geological considerations alone, it is possible to determine the date of this great event with some degree of precision.

"There are certain formations, which must have commenced immediately after the last catastrophe, and which from that period, have been continued up to the present day, with great regularity. Such are the deposits of detritus observed at the mouths of rivers,—the masses of rubbish which exist at the foot of mountains, and are formed of the fragments that fall from their summits and sides. These deposits receive an yearly increase, which it is possible to measure. Nothing, therefore, is more easy than to calculate the time which it has taken

them to acquire their present dimensions. This calculation has been made with reference to the debris of mountains; and, in all cases, has indicated a period of about four thousand years. The same result has been obtained from the other alluvial deposits. In short, whatever has been the natural phenomenon that has been interrogated, it has always been found to give evidence in accordance with that of tradition. The traditions themselves exhibit the most astonishing conformity. The Hebrew text of Genesis places the deluge in the year 2349 before Christ. The Indians make the fourth age of the world, that in which we now live, to commence in the year 3012. The Chinese place it about the year 2384. Confucius, in fact, represents the first king Yeo, as occupied in drawing off the waters of the ocean, which had risen to the tops of the mountains, and in repairing the damage which they had occasioned."

This result, so pleasing to the religious mind, has been attempted to be evaded by some ingenious writers, who, with considerable plausibility, have supported views altogether at variance with revelation, endeavouring to account for all the changes which have taken place both in the animate and inanimate creation, by a regular and uninterrupted succession of natural causes, continued for a vast but undefined period, amounting perhaps to millions of years; but with whatever ability these views have been supported, the straining of facts to which such writers are obliged to resort for the purpose of supporting a very untenable theory, is too apparent not to display the weakness of their cause. It is impossible, by any ingenuity, to mystify the fact that "mountains decay with years," and that there is a general tendency in nature to reduce all things to a level; which, in a period infinitely short of eternity, would reduce the sea to a muddy puddle, and the land to a swampy and pestilential marsh.

THIRTEENTH WEEK—SATURDAY.

VII. GEOLOGY.—EFFECTS OF THE DELUGE ON THE PRESENT SURFACE OF THE EARTH.

The geological marks of a universal deluge are very clearly indicated, not merely by the facts we have been already considering, but also by appearances of a different kind. Marine shells are every where found, even on the loftiest mountains. These give evidence, either that the ocean has shifted its bed, or that it has swept over the earth as Moses has described; or, what is perhaps most probable from other indications, that both of these causes have been combined. But there are proofs of the flood still more unequivocal. There are deposits every where, which geologists have justly considered diluvial, and which, from their position on elevated ground or gentle slopes, are easily distinguished from the accumulations of lakes and rivers. "In the whole course of my geological travels," says Dr Buckland, "from Cornwall to Caithness, from Calais to the Carpathians, in Ireland or in Italy, I have scarcely ever gone a mile, without finding a perpetual succession of deposits of gravel, sand, or loam, in situations which cannot be referred to the action of modern torrents, rivers, or lakes, or any other existing causes. And with respect to the still more striking diluvial phenomena of drifted masses of rocks, the greater part of the northern hemisphere, from Moscow to the Mississippi, is described by various geological travellers, as strewed, on its hills as well as valleys, with blocks of granite, and other rocks of enormous magnitude, which have been drifted (mostly in a direction from north to south), a distance, sometimes of many hundred miles, from their native beds, across mountains and valleys, lakes and seas, by force of water, which must have possessed a velocity to which nothing that

occurs in the actual state of the globe affords the slightest parallel."

The state of the earth's surface here described, must be familiar to every one who has any taste for observation. What we call soil is nothing else than rocks rubbed down by detrition, or decomposed by the action of the atmosphere, and afterwards mixed with the decayed vegetable and animal substances to which it has given nourishment; and it is striking to observe with what beneficence the action of natural causes has been made to clothe the earth with a covering so admirably adapted for the purposes of organic life. The agency of the deluge in the whole operation is very apparent. First has rushed over the earth a wave of amazing force, bearing along with it in its resistless current every thing which existed on the surface of the globe as it then was,—destroying, submerging, and dispersing, man and beast, with all the labours of human art; tearing up and floating away, or burying deep, tree and shrub, plant and flower; throwing wide over all climates the seeds of every vegetable production, to form the germs of a new vegetation in an altered world; moving from their primeval foundations the peaks of the ancient mountains, and hurrying them broken, scattered, and rounded into stones and boulders, to distant regions, and over a wide extent; scooping out ravines, and raising waving hills of gravel and clay in the lower grounds; and, as it swept over the level tracts, depositing part of the more heavy materials with which it was loaded. After this mighty torrent, occasioned by the sudden disruption of the solid crust of the globe, had begun to subside, the turbid waters, in their slower motion, had proceeded to deposit the lighter burden with which they were fraught. The mud of this agitated and shoreless ocean, mingled with rounded stones of various size, had been gradually precipitated, and had formed a sediment of various depth, which was to serve as the vegetable soil of the future land; and this awful agent having now fulfilled the high behest

of the Almighty, had gradually retired to those regions of the surface which were nearest the centre, obeying the universal law of gravitation, by which liquids find their own level.

That the actual state of the earth's surface corresponds very remarkably with this account of the manner in which a universal flood would naturally act, every one must, on the slightest survey, be sensible. But a more minute and careful examination strikingly confirms this general view. No one can look with a judicious eye on any extensive section of the upper deposits on the earth's surface, without being sensible of this. Sir James Hall turned the attention of geologists to the curious fact, that on the surface of sandstone, among the soil and debris which cover this early deposit, large boulders, sometimes of the same kind of rock, and frequently also of rock of a kind altogether foreign to the locality, are very often to be found; and that, where this is the case, the upper stratum of the rock is marked with grooves or scratches, generally lying in a southwest direction, and evidently attributable to the impression of these boulders, hurried along by the currents during the action of the flood. The Craigleith Quarry, in the neighbourhood of Edinburgh, which is remarkable as containing a very fine example of a fossil tree in the very heart of the secondary deposit, is a well known example of this. The intelligent manager of this extensive work, has traced these grooves over the whole surface of the quarry, wherever the diluvial soil has been removed,* and the same phenomenon is familiar to every person who is conversant with similar excavations. In the quarry of Corncocklemuir, for instance, where the footsteps of primeval animals have been discovered, it is evident that the whole upper surface of the strata has been forcibly torn off before the diluvial soil was deposited, and among that soil are found large portions of the sandstone detached from the living rock.

* Geology of Scripture, p. 345.

Dr Buckland doubts whether these proofs of a flood of immense force sweeping over the surface of the earth, should be referred to the Mosaic deluge, or to that which submerged the world immediately before the creation of man. "It has been justly argued," says he, "against the attempt to identify these two great historical and natural phenomena, that, as the rise and fall of the waters of the Mosaic deluge are described to have been gradual, and of short duration, they would have produced comparatively little change on the surface of the country they overflowed. The large preponderance of extinct species among the animals we find in caves, and in superficial deposits of diluvium, and the non-discovery of human bones along with them, afford strong reason for referring these species to a period anterior to the creation of man. This important point, however, cannot be considered as completely settled till more detailed investigation of the newest members of the Pliocene, and of the diluvial and alluvial formations shall have taken place." It is well to speak with caution when a sufficient number of facts have not been collected; but, for my own part, I see little force in the objections here stated. No deluge, which rose in a few weeks over the tops of the highest mountains, and enveloped the whole habitable globe, could possibly be tranquil. The discovery of extinct species may be accounted for by the extermination of such animals as the Creator saw would no longer be suitable to the new condition of the earth when it emerged from the waters; and the non-discovery of human bones in the places yet examined, by no means precludes the probability of finding them in the extensive regions of the East, yet unexplored, where it is universally believed the human race had their origin. Geologists jump too quickly to conclusions. How small a tract of the crust of the earth has yet been examined, and even that small tract how imperfectly!

If it should appear, however, that the organized exist-

ences of what Mr Lyell calls the Pliocene period of the tertiary formation, are sometimes, or even frequently, mingled with those which were destroyed and submerged at the Deluge, this is just what might be expected, on the supposition that the Pliocene period ended in a similar catastrophe. At the period of the Mosaic creation, these existences, both animal and vegetable, would, of course, be mingled with the *diluvium* which formed the surface of the new earth, and when the fountains of the great deep were again broken up at the deluge, that diluvium would be disturbed, overturned, and mixed, so as to enclose the remains of antediluvian organization in the same masses with those of the latest period of the immediately preceding formation.

In considering the whole subject of the deluge, including not only its physical appearances, unfolded by geological research, but its moral cause, as declared by the inspired volume, we cannot too much admire the Divine wisdom and goodness which has caused such a tremendous judgment to end in an arrangement so beneficial. The beautiful scenery of the earth, with its valleys and hills, covered with a green carpet of grass, and adorned with flowers, or waving with lofty forests, or gracefully interspersed with the smooth expanse of lakes, reflecting surrounding nature on their peaceful bosom, or with streams rolling their ever-flowing tide to the ocean; while the distant horizon melts away into blue mountains, whose tops reach the clouds,—all this is the result of that dreadful convulsion which offended justice inflicted as a deserved punishment on accumulated and increasing guilt; but which a paternal hand controlled, and an all-wise Providence converted, to purposes of mercy and love.

There is something unspeakably gracious in the promise made to Noah, when he and his family issued from the ark, and set their foot for the first time on a submerged, but renovated world. "I do set my bow in the cloud, and it shall be for a token of a covenant between

Me and the earth. And it shall come to pass, when I bring a cloud over the earth, that the bow shall be seen in the cloud; and I will remember my covenant which is between Me and you, and every living creature of all flesh; and the waters shall no more become a flood to destroy all flesh."—"While the earth remaineth, seedtime and harvest, and cold and heat, and summer and winter, and day and night shall not cease.'

With what a fine vein of poetic feeling has our most celebrated living poet alluded to this sublime and paternal declaration, in his address to the Rainbow:—

"When o'er the green undeluged earth,
Heaven's covenant thou didst shine,
How came the world's grey fathers forth
To watch thy sacred sign!

"And, while its yellow lustre smiled
O'er mountains yet untrod,
Each mother held aloft her child,
To bless the bow of God.

* * * * *

"How glorious is thy girdle cast
O'er mountain, tower, and town,
Or mirror'd in the ocean vast,
A thousand fathoms down.

"As fresh, in yon horizon dark,
As young thy beauties seem,
As when the eagle from the ark
First sported in thy beam.

"For, faithful to its sacred page,
Heaven still rebuilds thy span,
Nor lets the type grow pale with age,
That first spoke peace to man!"

CAMPBELL.

FOURTEENTH WEEK—SUNDAY.

THE DELUGE A DIVINE JUDGMENT.

THE account which the Bible gives us of the history of the antediluvian world, and of the causes which led to that awful interference of the great Creator, which brought it to a sudden and violent end, may be stated in few words. After man had proved himself unworthy of the world of happiness in which he was placed, it pleased the Eternal to continue his existence, under a new condition, both of his own mental and physical powers, and of the constitution of external nature. What that condition was, we have already partly seen. It was a state of things, in which sin, misery, and death, were to prevail, as a preparation for another and more glorious form of existence, to be obtained, by believers, through the mediation of a Redeemer; and it was also part of this new condition, that men should still be so far morally free, as to have it in their power to reject the offered salvation, and remain under the dominion of the prince of darkness. Thus mankind came to be divided into two great parties, as seen by the Omniscient eye,—those who, accepting of the promised Saviour, were maturing for the mansions of heaven; and those who, preferring the things of time to the hopes of eternity, were doomed to everlasting destruction. The external condition of men was, in the antediluvian world, early marked with a broad line of distinction, corresponding, in some degree, with their future destiny. There were two distinct races of the human family,—the one descended from the first murderer, acute, ingenious, and worldly, gave themselves entirely to the cultivation of those pursuits and pleasures, which begin and end on this side the grave; the other, taking their origin from a more high-minded

parent, and, like him, full of views and expectations, which looked beyond the present earthly scene, were animated by that Hope, of which it has been beautifully said, that she "lights her torch at Nature's funeral pile;" and made it the noblest aim of their lives, to walk worthy of their immortal destiny, and to prepare for the exalted employments and enlarged happiness of celestial natures.

In the slight glimpse afforded us of these two races, we find a striking example of a peculiarity in the human character, which our Saviour has noticed, and which has characterized man in every age,—that the children of this world are wiser in their generation than the children of light. Among the descendants of Cain, who are designated by Moses as the "children of men," we see much worldly wisdom. We find their peculiar character indicated in these short incidental notices,—they built cities; they possessed flocks and herds; they invented musical instruments; they dug into the bowels of the earth, and became artificers in brass and iron:—in short, they founded the arts of civilized life, and made large advances in its comforts and luxuries. Among the pious race of Seth, who were distinguished from the irreligious family by the honourable title of "Sons of God," we hear little of worldly accomplishments, though they doubtless studied the works of creation, that in them they might discern and adore the Creator's perfections, and were not neglectful of whatever might contribute to the comfort of social and domestic life, or enlarge the understanding, or improve the heart; but, what is of much greater importance, and indicates a far nobler character, in the descendants of that family, we find Enoch, who walked with God, and was not, for God took him, and Noah, who was just and perfect in his generations.

But the contagion of iniquity is fearful. In all ages, there is a predisposition towards it in the heart of every man, and probably its influence was greatly aggravated in the primeval epoch, by a life extending to many cen-

turies, and by the peculiar vigour of the bodily powers. Whatever force there may be in this latter observation, it is certain, that as soon as the pious race, merging their horror of irreligion in their admiration of human talent, began to cultivate a familiar intercourse with the infidel race, their characters from that instant began to decline; and, frequent intermarriages having taken place among them which hastened the disease, corruption became universal and inveterate, and the earth was filled with violence. At length the measure of their iniquity became full. The world, as it then was, had fulfilled its purpose, and the family of Adam had proved themselves incapable, under the circumstances in which they were then placed, of honourably fulfilling the relations of life, or of preparing for the enjoyments of a better world. A new constitution of things was to succeed, in which human life was to be curtailed, the world was to be rendered less exuberant in its vegetable productions, some of the largest animals, probably, were to be exterminated, and other corresponding changes were to be made in further development of the Divine decrees. A new step, in short, was to be taken towards the accomplishment of the primeval promise, that "the seed of the woman should bruise the head of the serpent."

The antediluvian world was therefore to be destroyed, and means having been taken for the preservation of all living species intended to people the new earth, from man to the minutest insect, "the fountains of the great deep were broken up, and the windows of heaven were opened;"—by some amazing convulsion, in which the agency of natural causes was probably employed, an irresistible and overwhelming flood poured over the face of the whole earth, and, amidst the jarring of commingled elements, the work of destruction was accomplished. This awful event is thus graphically described by Mr Sharon Turner, in the concluding sentence of his able work on the History of the Creation, &c.—"We can but faintly conceive the appalling scene. Mankind were

surprised, in the midst of their usual festivities and employments, by the sudden alarm of portentous danger, rapidly rushing on them from the blackening and howling sky. The sun was seen no more,—midnight darkness usurped the day,—lightnings dreadfully illuminated,—thunder rolled with unceasing fury,—all that was natural ceased; and, in its stead, whirlwind and desolation,—earth rending,—cities falling,—the roar of tumultuous waters,—shrieks and groans of human despair,—overwhelming ruin,—universal silence,—and the awful quiet of executed and subsiding retribution."

In the history of these first ages, a most instructive lesson is taught us with regard to the nature and consequences of mere human talent, destitute of divine illumination. Wedded to earth, the infidel branch of the human family sought an earthly reward, and obtained it. They "found out many inventions;" they increased in wealth, and surrounded themselves with conveniences and luxuries. In the eager course of selfishness, the boundaries of knowledge were extended,—desire was enlarged, the faculties sharpened, and the taste refined. But in this worldly progress what became of morality, and where was the place of religion? Alas! they had fled. The pursuits of the world are essentially grovelling;—they debase, harden, and contract the heart. Sensuality brutifies it; passion inflames it; evil communications corrupt it. Avarice is grasping, pride is arrogant,—ambition bloody. Even science itself, when pursued in a worldly spirit, is full of snares; in its self-sufficiency it usurps the sceptre of heaven, and banishes God from the throne of the universe.

The awful catastrophe of the Deluge presents the Almighty before our minds in the tremendous light of an avenging and unrelenting judge; and, in contemplating it, we seem to lose sight of the gracious attributes by which the Universal Parent is endeared to the hearts of His children. But, when we divest the event of those adventitious qualities which the excited imagination

throws around it, and view it in the pure light of truth, we perceive that, after all, except as regards time and manner, there was nothing more dreadful than what happens in the ordinary course of Providence. Every thing that lives is destined by the condition of its nature to die,—some in infancy,—some in the opening blossom of youth,—some in the full vigour of matured faculties, —and some in hoary age. And what greater calamity than this invaded the animal creation when the flood swept them away? They died, indeed, *together*, and the mode of their dissolution was violent and unusual. But was there not, even in these very circumstances, much to alleviate the calamity? What varieties of protracted suffering were avoided! How many pangs of heart-rending sympathy were spared! There were no torturing diseases,—no restless nights,—no tedious watchings,—no orphan children,—no sorrowing parents,—no widowed wives,—no bereaved husbands. To perish by flood! It is one of the easiest of deaths. To die together! It is a consummation which affection desires.

But beyond death! This is the awful thought.—Mysterious and appalling dispensation! Scene of horror and despair! Yet, in this respect, the Deluge was not different in its consequences from a common deathbed. The crisis was sudden, indeed, but if the world was taken by surprise, it was not for want of ample warning. During the eventful period in which the ark was building,—a period of a hundred and twenty years,—Noah was "a preacher of righteousness," and the "long suffering of God waited."* This intimates to us the opportunity which even to the very last was afforded for penitence, and shows to what extent the conscience was seared, and how irretrievable was the moral and religious character of the world. And what a warning does it afford to us! The world will never indeed be again overwhelmed by a flood;—but every individual of the human family, generation after generation, will go down to the dust from

* 1 Peter, iii. 20, and 2 Peter, ii. 5.

which he was taken, and his soul will be required of him for final judgment. We know not when this event will occur to any individual; but we are daily warned that the time is at hand; and ought we not to have "our loins girded about and our lamps burning?"

Nor must it be forgotten that the period is approaching when the world shall be destroyed, not indeed by water, but by fire; and that the latter catastrophe will come as suddenly and as little expected as the former. "As it was in the days of Noe, so shall it also be in the days of the Son of Man. They did eat, they drank, they married wives, they were given in marriage, until the day that Noe entered into the ark, and the flood came and destroyed them all."* How happy will those be who shall have taken shelter from such calamities under the everlasting wings, and to whom, in whatever form the King of terrors advances, he shall prove a messenger of immortal glory.

* Luke xvii. 26, 27.

END OF "WINTER."

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