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ART. IV.—1. *A Manual of Botany, being an Introduction to the Study of the Structure, Physiology, and Classification of Plants.* By JOHN HUTTON BALFOUR, M.D., F.L.S., F.R.S.E., Professor of Medicine and Botany in the University of Edinburgh. 1849.

2. *The Plant: a Biography.* By M. T. SCHLEIDEN, M.D., Professor of Botany in the University of Jena. Translated by ARTHUR HENFREY. 1848.

3. *Principles of Scientific Botany; or Botany as an Inductive Science.* By Dr. J. M. SCHLEIDEN. Translated by EDWIN LANKESTER. 1849.

4. *On the Archetype and Homologies of the Vertebrate Skeleton.* By RICHARD OWEN, F.R.S. 1848.

5. *On the Nature of Limbs.* A Discourse by RICHARD OWEN, F.R.S. 1849.

6. *The Typology of Scripture. Investigation of Principles and Patriarchal Periods.* By Rev. PATRICK FAIRBAIRN, Salton. 1847.

7. *The Typology of Scripture. Mosaic Dispensation.* By Rev. PATRICK FAIRBAIRN, Salton. 1847.

TWO great principles, as it appears to us, run through every part of the works of God. The one is the principle of Order, or a General Plan, to which every given object is conformed with amazing skill. The other is the principle of Special Adaptation, by which each object, while formed after a general plan, is at the same time and by an equally wonderful skill, accommodated to the situation which it is meant to occupy, and the purpose which it is intended to serve.

These two principles are characteristic of intelligence. They may be discovered, though necessarily to a limited extent, in human workmanship. When circumstances admit, man constructs his works upon a general plan. We see it in the cornyard of the farmer, who builds up his grain in forms which are after a particular mould. We detect it in the shop or wareroom of the merchant, where the articles are disposed in drawers of a like shape, or bound up in parcels of equal weight. Human intelligence delights to employ itself in forming such models. They seem to have a beauty to the eye, or rather to the mind, which contemplates them. Human convenience requires them. It is only when his possessions are so arranged that man can be said to have the command of them. Were his property not so disposed, were his grain gathered into heaps of all sizes and

shapes, were his merchandize scattered in every corner of the apartment, the possessor would become bewildered in proportion to the profusion and variety of his wealth.

While we see so obviously in the works of man the general model, we may also discover the principle of special adaptation. The farmer's stacks are all formed after a general mould, but we may observe a departure from it on either side to suit the quantity or quality of the grain. The merchant's shop seems to be regulated by forms and weights, but there is a special form and a model weight for every separate article.

We insist on having these two principles of uniformity and variety in all the higher works of man. We have them in a well-furnished house, where we see the one side of the chair and table of the same shape and size as the other side, but where there is also a variety in one kind of chair or table being after a different model of beauty from another. We see both illustrated in those pieces of furniture, in which there is something on the one side not of the same shape as something on the other side, but the counterpart of it, and intended to balance it. It is in the way of exhibiting these great principles, that we find in all the higher forms of architecture, a general correspondence in the whole, with a graceful diversity of particular parts. It is possibly because we insist on having these two principles in all the higher kinds of art, as we certainly find them in all the nobler departments of nature, that we have a central figure with other figures grouping around it, in all our finest historical paintings. The mind naturally constructs its workmanship in accommodation to these rules, and finds as it does so that it is ministering at once to the convenience and the delight of all intelligent beings.

Now, if this world proceeds from intelligence, if it is addressed to intelligence, we may expect to find in it the same two grand principles. We do find, we think, abundant illustrations both of the one and of the other.

The Principle of Order assumes a great diversity of forms. It may be an order, for instance, in respect of number, as when we find the threefold and fivefold symmetry prevailing to such an extent in the vegetable kingdom, and find all the laws of nature capable of a quantitative expression. It may exhibit itself in a beautiful conformity of colours, such as we find in the plumage of so many birds, and the spots and stripes on the skins of so many wild beasts, a conformity which does not, as Mr. Ruskin tells us, follow the physiological or anatomical structure of the animal, but follows a beautiful order of its own. Or it may be a uniformity in respect of form, and it is this that we are now specially to investigate. It cannot surely be either an unpleasant

or unprofitable inquiry which carries us into the very midst of that order and harmony which are so characteristic of works, which proceed, we must believe, from Infinite Intelligence.

But coincident with this principle, there is another, that of Special Adaptation, also running through the works of God. While there is a general form of limb, for instance, found in all mammals, there is a particular form to suit every given species, and the particular form is admirably suited to the circumstances in which the animal is placed, to the food provided for it, and the purposes which it is meant to serve. It must be no less interesting surely to discover the exceptions as well as the rule, to perceive how the exceptions fall under a different rule, and to find that the diversity is as beneficent as the uniformity.

After tracing this mingled uniformity and diversity throughout the more important kingdoms of nature, the vegetable and the animal, we may further inquire whether we do not meet with something similar in the dispensations of grace also, as revealed in the word of God, especially in the typical symbols, persons, and events described in the Old Testament. We say something similar—for it will at once be seen, that if our views are correct, there will with the uniformity be also a diversity. The typical system of the animal kingdom is of a different order from the typical system of the vegetable kingdom; and when we rise from matter to mind, from nature to revelation, we may expect to find the typical system, if there be a typical system, of a higher kind than that which pervades the organic world. But we can shew that each furnishes like evidences of lofty intelligence, and that all are equally suited to the same or similar principles in the constitution of man's mind. With such diversities as we might anticipate, and these diversities meant to serve a special purpose, we find a *system of types* running through the works of God, and this system adapted with wonderful skill to the objects to which it is applied.

To begin with the inorganic world. According to the creed which has been commonly adopted in modern times, matter is composed of atoms, and these atoms have regular forms. According to Sir Isaac Newton they are spherical, according to Dalton each has a specific magnitude. If these views be correct, we discover forms playing an important part in the original structure and composition of the material universe. On breaking up the rocks of the earth, we find in most of them a regular or crystalline form in the component parts, from which it has been argued that they are crystalline throughout. It is distinctly ascertained that minerals crystallize in the most regular manner, and that each mineral has its own crystalline form. Haüy, Mohs, and others, have reduced these crystals to certain

primitive forms, and minerals have been classified according to the form which they assume in crystallization. But it is evident that the rocks, as ordinarily presented to the eye, do not take any such regular form. On the contrary, nothing can be more disorderly than the common appearance of the rocks and earths, as they are found on the surface of our globe. At first sight we might be apt to complain of this, but on reconsideration we may easily be convinced, that if the surface of the ground had been covered with crystals, even though these had been crystals of gold or diamond, it would have been as inconvenient for man as the power given to Midas of turning all things which he touched into gold, and would not even have gratified his sense of beauty. The system of nature is a system of regularity amidst regular irregularity. The graceful forms of the organic world rise most beautifully from amidst the prevailing irregularity of the soil and rocks on the surface of the ground.

Still, the inorganic world is not without its morphological regularities. Each satellite is of the same form as its planet, and the planets are of the same shape as their sun. All the heavenly bodies seem to move in similarly shaped, that is, elliptic orbits. No doubt there are irregularities, as in the ring of Saturn; but occasional irregularities under the same grand law are as much the rule of God's kingdom as fixed and squared regularities. But it is in the Vegetable and Animal Kingdoms that we find *morphology* coming forth most prominently.

As all matter, organic and inorganic, is supposed to be formed of regularly shaped atoms, so organic matter, vegetable and animal, is now believed to originate in cells. The cellular structure of plants was discovered as early as the seventeenth century, by Robert Hooke, who used an instrument brought from the Continent, and was farther developed soon after by Malpighi, a professor at Bologna. It is now acknowledged that cells are the primary elements of all vegetable life, and by means of improved microscopes, physiological botany is trying, though as yet with but partial success, to penetrate the mystery of life, and to discover the way in which cells are formed. These cells are little vesicles, composed of a membrane usually transparent and colourless as water. According to Schleiden, the cell membrane, in its young state, is perfectly closed, but permeable to all fluids. It contains a fluid thicker than water, and this fluid having commonly an affinity for water, there is a constant passing in of water, and a passing out of the concentrated fluid from the cell. These cells vary in size, but may average $\frac{1}{1000}$th part of an inch in diameter. It is calculated that in some fungi they are generated at a rate of sixty-six millions in a minute. When allowed to develop themselves freely, they take a glo-

bular form. When supplied with nutrition unequally, they take more flattened or elliptic shapes. When a number of cells press on one another they become many-sided. When perfectly formed cells of the same size are allowed to press against each other, they will be seen as beautiful rhombo-dodecaedrons under the microscope. The individual cells are grouped together in a variety of ways into great masses called tissues, which are of various kinds, and go by various names. The simplest is the parenchyma, formed by an agglomeration of cells. Then there are the vessels, formed by a row of lengthened cells, whose cavities through resorption have been brought into continuous communication; and there are the vascular bundles composed of a mass of lengthened cells, formed partly into vessels and penetrating the parenchyma. "The cell," says Professor Balfour, in his admirable elementary work on Botany, "is the basis of all vegetable structure. It is of equal importance as regards function. In the lowest plants cells constitute the whole substance, they absorb and assimilate, thus performing the functions of nutrition and secretion, and they form new cells, thus reproducing individuals like themselves. When a more complete structure exists, as in the higher tribes of plants, certain cells are appropriated for absorption, others are concerned in assimilation, and others in forming and receiving secretions. When a certain degree of solidity appears to be required to support the stem, leaves, and flowers, ligneous substance is deposited, and woody fibre is formed. When the transmission of fluids and air is carried on rapidly, the elastic fibres of the fibrovascular tissue seem to keep the elongated cells and vessels pervious; and when the elaborated sap is conveyed continuously, without interruption, anastomosing tubes occur in the form of laticiferous vessels." It is out of these cells, chemically and mechanically compound, but vitally simple, each possessing a perfectly independent life, the law of which has not been ascertained, that all the plants of the earth with their infinitely diversified shapes and functions are formed. These cells are the living stones of which this great temple of nature is built. The life of the plant is the result of the life of its individual cells. It is not unworthy of being noticed, though at present little can be founded upon it, that certain numbers occur in the formation of young cells, in by far the majority of cases, two, four, and eight young cells being formed within the parent cell.

The natural shape of the cell is the globular, a form unseen by the naked eye. The first regular form which falls under the notice of the unassisted vision is the spiral, a figure which combines in itself our two principles of unity and variety. The microscope first of all shews us this form, appearing in the inner

surface of the cell. When the cell has reached a certain degree of development, the cellulose is deposited upon it as a concrete layer which takes the figure of a spiral band. But the spiral figure also appears in parts of the plant which strike the naked eye. The arrangement of leaves and of other appendicular parts round the stem or axis of a plant is very frequently spiral. Leaves seem to be arranged in a more or less spiral manner. Thus, in the case of the apple, the pear, the willow, the oak, and many other trees, if a line be drawn round the tree, from the base of one leaf to the base of another, it will be found that a perfectly spiral line has been described. Lindley thinks it probable that the normal position of all leaves upon the stem is alternate, and consequently that a line joining these bases will be an elongated spiral. The scales of the pine and fir cone are arranged in spires, and between these spires there are certain arithmetical or mathematical relations of a most singular description, which have given rise to curious speculations. It has been laid down by some botanists as a general fact, that beginning with the cotyledons or seed-lobes, the whole of the appendages of the axis of plants, leaves, calyx, corolla, stamens, and carpels, form in their normal state an uninterrupted spire governed by laws which are nearly constant. The spiral tendency is likewise seen in climbing plants and the tendrils of plants, as also in the twining stem of some plants, which look as if they were twisted round their own axis.

With the exception of the spherical forms of individual cells, which are unseen by the naked eye, no regular mathematical figures are to be found in the shape of plants or the parts of plants. All this is in striking accordance with the native principles of beauty implanted in the human mind. Had our trees been triangular, our shrubs quadrilateral, and our grasses spherical, we feel that we should have been constrained to do what Pascal did, to shut up our casement, that we might not see the landscape; but from motives very different from those of Pascal, for while he durst not look on Nature's scenes because they were so beautiful, we would not be able in these circumstances to look upon them because they were so ugly. When the commonwealth of taste is properly constituted, one of its first laws will be passed against the clipping of boxwood and holly, and the common pruning of trees, which has no respect to their natural form. We can excuse the old Scotch earl who planted his trees in groups to represent the troops which gained a victory under him, because, while he thereby spoiled the beauties of nature, he gave us some insight into the military art; but those who form spherical yews and conical laurels, should themselves be subjected to a similar pruning process, because of the offence which

they commit against nature without, and nature within us. Meanwhile, let us be grateful that no such enormities are committed in the works of God. There is attention at once extensive and minute paid to form in the vegetable kingdom, but this form intentionally admits of variety along with the unity. The unity is sustained by the symmetry, or the two equal or balancing sides, which appear in the plant as a whole, and in all its foliar appendages; and the variety is exhibited in the infinitely diversified waving lines of their outline as seen between us and the sky in the back-ground. It is a circumstance worthy of being noticed, that while the even numbers, 2, 4, 8, prevail in the formation of cells which are unseen without artificial aid, the uneven numbers, or a centre with two sides, appear in the ramification of branches, the venation of leaves, and the whorls of flowers. Naturalists divide the vegetable kingdom into monocotyledonous, which are also endogenous, and dicotyledonous, which are exogenous plants; and it is found that three is the typical number in the former, and five, the typical number, in the latter class.

But it is in the external forms of plants that we see this doctrine of types most strikingly exhibited. The department of botany which treats of these forms is called Morphology. Lindley represents it as the basis of all scientific knowledge of vegetable structure; Schleiden speaks of it as the most important section of botany; and Professor Balfour says, it is now the basis of organography, and he has kept it in view throughout his whole treatment of the organs of plants. This department of botany was unknown before the time of Linnaeus, and even he had but a limited notion of its importance. It was first presented in its true light by the great German poet Goethe, who, though not learned in the artificial systems at that time taught in the schools, had a fine eye for the objective world. As Goethe had no name among the initiated, his views were long neglected by the scientific world. It was about thirty years after they were published that they were brought into notice by De Candolle and others. Under some modifications they have now commanded the assent of the most sagacious and practical of British naturalists, men slow to admit German theories in any case, and who never do admit them till they have accommodated them to their own common-sense type.

The fundamental law of morphology is, that certain plants are constructed upon the same general plan. The perfect plant may be regarded as composed of two essentially distinct parts, the STEM and the LEAF. Looking first to the STEM, we find the whole skeleton of the plant composed of a number of stems developed the one from the other, in lineal succession. The stem going downwards becomes the root, and proceeding up-

wards becomes the trunk. From the main stem, both in its upward and downward course, there proceed lateral stems or branches, and these lateral stems may again send out other stems or branchlets. It is to be observed, that these stems are all as it were repetitions of each other. The main stem, all the lateral branches, and the branchlets proceeding from these, are of the same structure, and tend to assume the same form. "If a thousand branches from the same tree are compared together," says Lindley, "they will be found to be formed upon the same uniform plan, and to accord in every essential particular. Each branch is also, under favourable circumstances, capable of itself becoming a separate individual, as is found by cuttings, buddings, grafting, and other horticultural processes. This being the case, it follows, that what is proved of one branch is true of all the other branches." Thus the smallest branchlet becomes a type of the branch on which it grows, and the branch a type of the trunk from which it springs. Knight and Du Petit Thouars delight to represent every plant as composed of an assemblage of individuals, each, as it were, with a separate life, and capable in certain circumstances of living independently, and it has been customary to designate the individual part or plantlet by the word phyton. It should be remarked at the same time, that though the plant is composed of a number of individuals, yet that these are so arranged as that the whole is one individual.

The other essential part of the plant is the LEAF. First we have the leaves properly so called, which commonly have a simpler form low down on the stem, assume their fully developed figure farther up, and return to greater simplicity at the extremity. Then we have leaves metamorphosed into a number of other organs; indeed, it is now acknowledged that all the other parts of the plant, except the stem, can be reduced to this type. "Linnaeus," says Schleiden, "had a presentiment of something of the kind, and in his *Prolepsis Plantarum* carried it out in such a way that, starting from the consideration of a perennial plant, with regular periodicity of vegetation, as in our forest trees, he explained the collective floral parts, from the bracts onward, as the collective foliar product of a five-year old shoot, which by anticipation and modification was developed in one year. This view is, in the first instance, taken from the most limited point possible, from the examination of a plant of our climate; and, secondly, imagined and carried out with great want of clearness." The first correct statement of the doctrine was made by C. Fr. Wolff, (Theoria Generationis, 1764,) but his treatise lay neglected till the truth had become established through the influence of others. Goethe wrote his *Versuch die*

*Metamorphose der Pflanzen zu erklären*, in 1790, a work which has laid the foundation of morphology as a department of botany, and of scientific botany as built upon it. The botanists paid little attention to his ideas, till long after when they were mentioned by Jussieu, and brought into general notice by the *Organographie* of De Candolle, published in 1827. The doctrine of the metamorphosis of plants is now acknowledged by all the great doctors, and has been sanctioned by the great councils of science.

Looking to the flower or inflorescence of a plant, we have first of all the outer cup or calyx, composed evidently of leaves called sepals, which are commonly of a green colour. Within this we have the corolla, or flower in the narrow sense of the term, composed of leaves called petals, alternating with the leaves of the calyx. Within this whorl we have the stamens, which are metamorphosed petals, and which do, in certain circumstances, become petals. In the centre of the inflorescence is the pistil with the seed vessels. Linnaeus had no idea that this could be a foliar organ. We owe the proper conception of the seed vessels to Goethe, who thus writes, "Keeping in view the observations that have now been made, there will be no difficulty in discovering the leaf in the seed vessel notwithstanding the variable structure of that part, and its peculiar combinations. Thus the pod is a leaf which is folded up and grown together at its edges, and the capsule consists of several leaves grown together, and the compound fruit is composed of several leaves united together round a common centre, so as to form a communication between them and their edges adhering together." Thus we have the organs of the inflorescence, calyx, corolla, stamens, and pistils reduced to foliar organs. Not that we are to regard them as leaves properly speaking, or even as metamorphosed leaves, for they never have been leaves, but they are formed after the same plan as leaves, but modified to suit the special purpose which they have to serve.

According to this idea a plant is composed of two essentially distinct parts, the stem and leaf. The leaf is formed upon the ascending stem, and besides its common form it assumes, while obeying the same fundamental laws, certain other forms, as bracts, sepals, petals, stamens, and pistils. Schleiden in his "Plant, a Biography," gives us a picture of a typical plant constructed on this principle. This makes a plant a dual, or composed of two essentially different parts.

But we have at times thought it possible to reduce a plant by a more enlarged conception of its nature to a unity. According to our idea, it consists essentially of a stem, sending out other stems similar to itself at certain angles, and in such a regular

manner that the whole is made to take a predetermined form. The ascending axis, for instance, sends out at particular normal angles for each tree branches similar in structure to itself. These lateral branches again send out branchlets of a like nature with themselves, and at much the same angles. The whole tree with its branches thus comes to be of the same general form as every individual branch with its branchlets, and every branch with its branchlets comes to be a type of the whole plant in its skeleton and outline.

Taking this idea of a plant along with us, let us now inquire whether there may not be a morphological analogy between the stems and the ribs or veins of the leaf. The veins of the leaf are vascular bundles proceeding from the fibrous matter of the stem, and may very possibly tend to follow the same laws. We are quite aware that in respect of physiological development there is a difference between the two, but this shall just render the morphological resemblance if it exists the more striking. We begin with the examination of those plants which have a fully veined or reticulated leaf. In maintaining that there is a morphological analogy between the ramification of the stems, and the venation of the leaves, we always assume, *that both stem and leaf are fully and fairly developed.*

In prosecuting this inquiry let us first inspect in a general way the leaf of a tree, with its central vein or veins, and its side veins. Even on the most careless inspection the central vein will be found to bear a striking analogy to the central stem or axis of the tree, and its side veins to the branches. Having viewed the leaf in the first instance, let us then look at the tree when stripped of its leaves in winter, and we may observe how like it is in its disc and in its skeleton to the disc and skeleton of the leaf. We shall be particularly struck with this if we view it in the dim twilight, or the "pale moonlight" between us and a clear sky. In both leaf and tree we see a central stem or stems, with lateral stems going off in a ramified manner at certain angles, and we may observe that the tree in its outline tends to assume the form of a leaf.

The general impression produced by a first glance will be confirmed on farther inspection. The analogy between the skeleton of the leaf and the skeleton of the whole tree may be seen in a number of special points, as well as in the general fact that the stems and the veins are both ramified. (1.) Some trees, such as the beech, the elm, the oak, and the greater number of our ornamental lawn bushes, as the holly, the Portugal and bay laurels, the privet, the box, will be found to send out side branches along their stem from the very root, or near the root, and the leaves of these trees will be found to have little or

no petiole or leaf-stalk. Other trees, again, such as the common sycamore (the Scotch plane), the birch, the chestnut, the lime, the pear, the cherry, the apple, have a pretty long unbranched trunk, and the leaves of all these trees have a pretty long leaf-stalk. (2.) Most of our low, bushy, branching herbaceous plants, such as tussilago, rhubarb, mallow, marsh marigold, lady's mantle, send out simultaneously a number of stems or stalks from the root or near the root; and it will be found in exact correspondence with this, that there run off from the base of the leaf a considerable quantity of main veins or ribs, which make the leaf assume more or less of a circular form. In this respect these plants are different from our forest trees, which send up commonly one main axis with lateral branches, and have in their leaves one leading vein with side veins. (3.) Some trees, such as the beech, the birch, the elm, the oak, send up one large main stem, from which, throughout its length, there proceed comparatively small branches pretty equably along the axis, and it will be found in such cases that the leaf has a central vein with pretty equally disposed veins on either side. Other trees, again, tend rather to send off at particular heights a number of comparatively thick branches at once. This is the case, for instance, with the common sycamore, the chestnut, and laburnum. The trunk of the plane tree, about eight or ten feet above the surface of the ground, commonly divides itself into four or five large branches, and in precise analogy, we find the leaf, at the top of a pretty long leaf-stalk, sending off five large veins. The chestnut often sends off at the top of its unbranched trunk a still greater number of branches, and we find in correspondence with this that its leaf is commonly divided into seven leaflets. The laburnum (and also the broom and clover) go off in triplets both in respect of veins and branches. In such cases it will commonly be found that the leaf is compound, *and we are to regard all such compound leaves as the proper representative of the whole tree.* (4.) The leaves of some plants, such as the rhododendron, the azelia, and the lupin, have a tendency to assume a whorled arrangement, and the branches of these plants also tend to become verticillate. (5.) The stems of some trees, such as the thorn and laburnum, are not straight, and the branches have a twisted form, and it will be found in such cases that the venation is not straight, and that the leafage is not in one plane. (6.) In some trees, such as the beech, the branches go off in nearly straight lines, and the leaves are found to have a straight venation. In other trees, again, such as the chestnut, the branches have a graceful curve, and the veins of the leaves are curved in much the same manner. (7.) In most plants the angle at which the side stems

go off will be found to widen as we ascend to the middle of the tree, and thence to decrease as we ascend to the apex; and the venation of the leaves will be found to obey a similar law. This structure helps to give to both tree and leaf the graceful curve by which their outline is distinguished. In other trees, such as the birch and poplar, the angle both of ramification and venation is widest at the base, and will be found to decrease as we ascend, giving both to the coma of the tree and the leaf a kind of triangular form. (8.) Generally, after having made a number of measurements, we think we have discovered a general correspondence between the angle of the ramification of the tree and the angle of venation of the leaf. This investigation, however, requires to be conducted with a considerable amount of caution. For while it is not difficult to discover the angles of the veins of leaves, it is far from being easy to find the normal ramification of a tree, for the angle at which the branch goes off is modified by a vast number and variety of circumstances, natural and artificial. All that we argue for is a *tendency* in the ramification and venation to obey the same laws.*

We are strongly inclined, then, to the opinion that in plants with leaves that strike the eye, the leaf and plant are typically analogous. The leaf is a typical plant or branch, and the tree or branch a typical leaf. We are quite aware of the differences which exist between these two distinct members of the plant. In particular, we find in the case of the full tree that branches go off all round the axis, whereas in the leaf the fibrous veins all lie in one plane. But then we have something to connect these two in the branch, the branchlets of which commonly lie in one plane. The principal difference between the tree and leaf may possibly be found to lie in this, that the cellular tissue or parenchyma, which in the tree and its branches is collected into the pith and bark, (which are connected by the medullary rays,) is in the leaf so spread out as to fill up the interstices in the fibrous matter which forms the veins.

The general order, as thus stated, can apply only to plants which have pith and bark, and which have fully formed veined leaves intended to strike the eye. In the plants with linear unbranched leaves, such as firs and pines, the order is modified to suit the different physiological structure and different form of the plant. Here the leaf does not correspond to the branch or tree, but merely to the stem. But here, too, we discover the same grand typical principle in every internode being of the

* We use this language because it will require farther investigation to determine the extent or limits of the general view now advanced. We shall be satisfied if this article leads men of science to pursue this investigation, even though this should occasion the partial modification of some of our special statements.

same form as every other, in every branch taking the form of the whole tree, in the growing or topmost internode with its leafage being of the same outline as the whole tree or branch on which it grows, and in the very cones being in many instances types of the whole tree and of every branch.

We are not prepared to say how this principle is carried out in the monocotyledonous plants. Some of these, such as our common grasses and lilies, have no branches, and the leaves of these plants have their veins parallel, or nearly parallel, to each other. In order to discover the law of order in the case of the palms, they would require to be examined in their native climes. Some plants of this class, such as the dictyogens of Lindley, to which belong yams, have branches like our ordinary forest trees, and it is a curious circumstance that the leaves of these plants have a reticulated structure.

So far as fungi, lichens, algæ, and the whole acotyledonous plants are concerned, it is evident that they present a repetition both of homotypal parts and of homotypal arrangement of parts or forms, and thus illustrate our general doctrine, that throughout the vegetable kingdom the parts are similar to one another, and in nice accordance with the whole.

Generally, we are inclined to regard the fibrous veins of the leaf as bearing a morphological analogy to the stems of the tree. The root, the stemmage, and the leaf are, in our view, the three distinct members of the fully developed plant,—these three parts, however, being morphologically allied, so that, to adopt the phraseology of Professor Owen as applied to another subject, (which we are now to examine,) they may be called homotypes. The plant thus becomes a unity with unnumbered diversity of parts.

We turn to the science of Comparative Anatomy, which furnishes illustrations of the same great principles. There was in the last age a famous controversy, which may be summarily represented as a dispute as to which of these two great principles we should discover in the animal structure. This controversy should now be regarded as settled in the discovery of both principles. The most illustrious comparative anatomist of the last, or indeed of any age, proceeded in all his investigations on the principle that every particular member of the animal body had a special use or final cause. Attached to this principle, and having found how prolific it was, in his hands, of brilliant discoveries, Cuvier was not very willing to admit a general correspondence of parts which could have no reference to the well-being or special functions of the animal. On the other hand, his great co-operator and rival, Geoffroy St. Hilaire, was accus-

tomed to speak in a scoffing manner of the doctrine of final causes, and delighted to trace a unity of plan running through the bones of the skeleton. The doctrine of final causes, as illustrated by the former, was made to furnish numerous and, we believe, incontrovertible proofs of the existence of a Supreme Intelligence; while the doctrine of a general plan, irrespective of the animal wants, was turned, as we think, most illogically, against the cause of natural religion. This controversy became still more embittered when Lorenz Oken, attached to the pantheistic school of Schelling, developed his doctrine of the brain being a vertebrate column. Some we suspect supported the doctrine of a physical uniformity of parts because it seemed to deliver them from the necessity of calling in final causes, while not a few regarded it with suspicion because it seemed to be atheistic or pantheistic in its tendency. There was a still greater repugnance felt to the doctrine of Oken on the part of many British anatomists, because of the transcendental method which he employed in developing it, and the mysticism in which it was embedded. We owe to the greatest of living comparative anatomists, the clear and correct statement of the great truth of a unity of plan running through the whole vertebrate skeleton; and his statement of the doctrine has been followed by its almost universal adoption. Professor Owen's views were first partially given to the public in the Geological Transactions for 1838, and were afterwards more fully developed, and communicated to the Royal College of Surgeons in the Hunterian Lectures for 1844 and subsequent years, and to the British Association at its meeting at Southampton in 1846. The public have now the matured and complete results in the great work on the Archetype and Homologies of the Vertebrate Skeleton, published in 1848, and in a Lecture on Limbs, published in 1849,—works which will constitute an era in the progress not only of comparative anatomy, but of the theistic argument as founded on the structure of the animal frame. The old controversy should now cease in the adoption of both doctrines, that of a general homology and that of a special adaptation of parts; and the former properly interpreted will be found, we are convinced, to yield as rich a contribution to the cause of natural theology as the latter.

By a "Homologue," Owen means the same organ in different animals under every variety of form and function. Thus, the pectoral fins of the fish, the wings of the bird, the fore-feet of the mammal, and the arms and hands of man, are said to be homologous parts, because they are really the same organs under different modifications. Such homologies as these have long been noticed even by the unscientific observer. But anatomists have now demonstrated, that in comparing one species

of animal with another there are similar homologies in every part of the skeleton. Professor Owen furnishes us with a plate forming a perfect study in itself, in which we have a series of about seventy homologous parts traced through all the vertebrate series of animals from fishes up to man. In this plate we have, first, an imaginary figure, an archetypal skeleton; secondly, the skeleton of a fish; thirdly, of a reptile; fourthly, of a bird; fifthly, of a mammal; and, sixthly, of man. In contemplating this plate we are invited to observe how an immense number of bones marked each by its number in the skeleton, and designated by its common scientific name in the margin, are to be found in the fish, the reptile, the bird, the mammal, and man, thus proving that they are formed after a common model. But while the same parts or organs are found in each of these classes of vertebrate animals, they are made to assume very different positions and sizes, in order to suit the particular species of animal. Thus, the fore-limbs become fins in fishes, claws in reptiles, wings in birds, long bounding legs in mammals, and arms and fingers in man. There is shewn to be a similar transformation of the rest of the seventy homologous parts to suit the convenience of the living creature.

In his great work on the Homologies of the Vertebrate Skeleton, Professor Owen treats, first, of special homology, or the homology of special organs. He next discusses general homology, and shews that there is not only a homology of certain organs, but a general plan or homology for the whole vertebrate skeleton. In the third place he treats of serial homology, and shews that the vertebrate skeleton is made up of a series of segments, which he calls "homotypes," repeating each other. We shall dwell for a little on these serial or repeating homologies, as illustrating our doctrine of similar parts being made to appear ever and anon throughout the kingdoms of nature.

The characteristic of the higher class of animals is the possession of a back-bone or vertebrate column. This column is composed of a series of segments or similar parts succeeding each other in the axis of the body. "These segments are not, indeed, composed of the same number of bones in any class, or throughout any individual animal; but certain parts of each segment do maintain such constancy in their existence, relation, position, and offices, as to enforce the conviction that they are homologous parts, both in the constituent skeleton, and throughout the series of vertebrate animals. For each of these primary segments, I retain the term vertebra." Professor Owen then exhibits what he reckons an ideal typical vertebra. It has a solid central part, a centrum which serves to give rigidity to the body, and support to the limbs. Above it, and forming a protection to the great

nervous chord which comes down the back, is the neural arch, composed of two neural processes (apophyses), surmounted by the neural spine. Below it, and covering the great descending artery and the other vital organs of the body, is the hæmal arch, composed of two hæmal processes, with the hæmal spine. On each of the sides of the centrum there is also a canal circumscribed by a costal process, and by two transverse processes. Besides these processes, there are also two articular processes connecting the parts of the neural and hæmal arches. The typical vertebra is thus composed of ten separate parts, a centre, a neural and hæmal spine, and seven processes which also support diverging appendages to be afterwards spoken of. Now, if we examine the several joints of the back-bone we find these essential parts appearing, though under very different modifications, from the top of the neck to the tip of the tail. These parts, indeed, are in some parts of all animals so altered from their typical form, that it is difficult to detect them. Still the skilful anatomist can trace them under all their various modifications, and finds it convenient to describe them by common names. Certain of the processes (apophyses) are in the body of the animal, ribs to protect the great vital organs. In the neck we do not find ribs, because they would injure the free motion of the neck; but we do find the rudiments of ribs. In the tail we have no ribs, but we have the homologous processes employed to embrace certain blood-vessels. Thus, from tail to neck inclusive, the vertebrate skeleton is composed, throughout all animals from fishes to man, of a series of parts essentially of the same order, but wonderfully modified to suit the function which the organ has to perform in the given species of animal.

So far these views will readily be acknowledged even by the anatomists of the school of Cuvier, who did much to establish the doctrine. But comparative anatomy is seeking to go beyond this, and would represent the skull itself as composed of a series of vertebræ. It would appear that Goethe had been dabbling in this subject also before the end of last century; but it was Oken, proceeding on a favourite idea of the school of Schelling that we are to seek the repetition of the whole in every part, who obtained the first clue to the discovery in August 1806. Walking one day in the Hartz Forest, he saw before him the blanched skull of a deer, and picking up and contemplating the bones, the thought flashed across his mind, "This is a vertebrate column." He afterwards tested and matured this idea, by examining the skulls of a cetacean, a chelonian, and a cod-fish, in the museum at Bremen, and published his generalization in a Lecture on the Signification of the Bones of the Skull. "As the brain," says he, "is a more voluminously developed spinal chord, so is the

brain-case a more voluminous spinal column." This idea has since been subjected to a sifting examination by various German, French, and British anatomists. Professor Owen, while adopting it so far, has considerably modified it. According to him the skull is not a separate column, but a series of vertebræ homologous to the series in the back-bone.

Proceeding onward from the neck we find the spinal chord becoming expanded in the brain into a globular mass, and we are according to this doctrine to regard the bony envelope which protects it as just a continuation of the series of vertebræ of the back-bone, these vertebræ being greatly modified to suit the end which they have now to serve. The skull, it is well known, is made up of parts which can be separated from each other, and these parts can be arranged in a series of segments, each of which contains the central cylinder, and the various processes which constitute the typical vertebra. Owen reckons the cranium as made up of parts corresponding to four vertebræ, but he does not seem to be sure whether there may not be other vertebræ in the cranium not fully developed. There are other anatomists who discover seven vertebræ in the skull, and perhaps this may be regarded as a proof that the doctrine, at least in some of its details, is not fully settled.

Proceeding on this method we have discovered the morphological signification of the back-bone, the tail, the ribs, and the skull itself. The question now comes to be started, what are we to understand by the limbs of animals? Professor Owen answers this in a deeply interesting and eminently suggestive Lecture on *Limbs*, delivered before a distinguished audience in February 1849, with all that grace of manner and elegance of language which, together with his learning and the comprehensiveness of his views, render him one of the most accomplished of living lecturers. In this lecture he shews that there are homologous segments appearing in the limbs of fishes, reptiles, birds, mammals, and man, though the limbs have to perform very different functions in each of these kinds of animal. He exhibits to us, first, the pectoral fin of the marine animal, the dugong; secondly, the fore-limbs of the mole; thirdly, the wing of the bat; fourthly, the leg of a horse; and, fifthly, the arm of man; and he shews how certain essential parts run through all these limbs, and maintain a uniform structure even when such different functions have to be performed as that of diving and swimming, burrowing and running, climbing and flying. It is a curious circumstance that every segment, and almost every bone present in the human hand and arm, exist also in the fin of the whale, though they do not seem required for the support and movements of that undivided and unflexible paddle. In many ani-

mals, indeed, some of the homologous parts, as for instance, certain of the fingers and toes, are not fully developed or are awanting, but in such cases they will often be found in a kind of rudimental state, or when absent we can tell what precise homologous parts are awanting, and what are present. The fore-leg of the horse wants the first and fifth finger, but has the second and fourth in an undeveloped state in the splint-bones, while the foot corresponds to the mid-finger, and the hoof is just the nail of that finger enlarged beyond the normal size.

Professor Owen next seeks to settle the higher question, what are we to understand by limbs in relation to General Homology? We cannot give his processes; we must content ourselves with giving his results. We have already said that in the vertebra, besides the central part and the apophyses running off from it, there might also, though not essential to the vertebra, be certain appendages. From the hæmal or lower arch of the vertebra in particular, certain appendages are found to proceed. Owen traces them in a rudimental state in various vertebræ of the animal frame, and after an extensive induction, he comes to the conclusion that the scapula is the hæmal arch, and the human hands and arms the diverging appendages of the hæmal arch, belonging to the lowest segment, the occipital segment of the skull. The hind-limbs are shewn by a similar process to be costal appendages of a pelvic vertebra. The whole skeleton, skull, back-bone, and limbs, including the whole vertebrate axis from the head to the tail, and all lateral parts, such as ribs and feet, are thus reduced to a unity, in a series of segments repeated in their essential characters, though infinitely diversified, to suit the particular purpose of the member.

We may state the conclusion in the words of Professor Owen:—"General anatomical science reveals the unity which pervades the diversity, and demonstrates the whole skeleton of man to be the harmonized sum of series of essentially similar segments, although each segment differs from the other, and all vary from the archetype."

"If," says Professor Sedgwick, in the fifth edition of his Discourse, in commenting on these speculations, "there be an archetype in the vertebrate division of animated nature, we may well ask whether there may not be a more general archetype that runs through the whole kingdom of the living world. In a certain sense there is. All animals, if we except the radiata, which come close to a vegetable type, are bilateral and symmetrical, have double organs of sense, and have a nervous and vascular system, with many parts in very near homology, even when we put side by side for comparison the animal forms taken from the opposite extreme of Nature's scale. And even in the

radiata, where we at first sight seem to lose all traces of the vertebrate type, on a better examination many of the genera are proved still to be bilateral and symmetrical."

These types appear not only throughout the whole series of animals, from the lowest to the highest, but throughout the whole Geological Series, from the earliest to the latest. It is now asserted that so long ago as the age when the old red sandstone was deposited in a district of what is now North America, there was a reptile who left the print of his foot in the sand, and this footprint turns up in the present day to shew that the animal had five toes. Coming down to the age of the new red sandstone, we have numerous footprints of reptiles, where again the five toes appear. In due time man appears, and is found too with five fingers on each hand, and five toes on each foot. Buckland tells us that in the "fore-paddle of the plesiosaurus, we have all the essential parts of the fore-leg of a quadruped, and even of a human arm; first the scapula, next the humerus, then the radius and ulna, succeeded by the bones of the carpus and metacarpus, and these followed by five fingers, each composed of a continuous series of phalanges. The hind-paddle also offers precisely the same analogies to the leg and foot of the mammalia; the pelvis and femur are succeeded by a tibia and fibula, which articulate with the bones of the tarsus and metatarsus, followed by the numerous phalanges of five long toes."

We cannot dwell on this part of the subject, but we must be permitted to say in passing, that the doctrine we are now expounding gives, if we do not mistake, the true meaning of such authenticated facts as the author of the *Vestiges of Creation* has woven into his plausible, yet withal exceedingly superficial work. But it gives no foundation whatever to the theory which he has reared on these facts, after having mingled with them many unauthenticated and mistaken statements. That there has been an order, and upon the whole a progression in the animal creation, should be admitted by all geologists. But it is an order, not in the nature of things, but in the plan of the Creator. It is not that one species has run into a higher by physical laws, but it is that the higher species is constructed after the same type as the lower.

He who maintains, that because there is a progression in the works of God, therefore the inferior has developed itself by natural law into the superior, is about as far-sighted and sagacious as the child who, on seeing a great number of vessels in a pottery, made all after nearly the same mould, but of different sizes, concluded that the large vessels had grown from the little ones. This progression is one of those collocations which John Stuart

Mill would call ultimate facts, that is, in physical investigation they are ultimate facts; and if we wish to go farther, as we think we ought, we must trace them to the designing mind of the Creator. For there has been no authenticated instance of one species of animal being transmuted into another; and there has been as perfect an induction, as physical science admits, in favour of the necessary separation of species and genera. We do not know of any law of nature which has been established on a larger or more invariable induction. He who would set it aside, on the pretence of explaining all things by natural law, must in the very act be setting aside natural law. The nameless author of "The Vestiges" should best know his own genealogy, and he may owe his insight into man's origin from the monad through the mollusc and mammal, to the circumstance of his having been himself generated in this manner; but until he manfully discloses himself, and produces such a fact in favour of his transmutation theory, we must claim to ourselves a nobler, if not so "endless" a genealogy, and assert that man is the "son of Adam, which was the son of God." When he has convinced us of his theory, we shall expect, as the next product of natural law, to hear of one who has risen so far above his ancestors, begetting a son belonging to a species as far above the human species as man is above the brutes. But we may safely leave the author of "The Vestiges" in the hands of Mr. Hugh Miller and Professor Sedgwick.

If there be then such a prevalence of typal and archetypal forms, the question arises, what is the final cause of it? Professor Owen does not seem to know what to make of the doctrine in this respect. He protests, indeed, that it cannot be employed to favour Atheism, but he does not seem to have a settled conception of its true religious signification. He is ever asserting that the facts of anatomy do not admit of an explanation on purely teleological principles; and so far we agree with him, if by teleology a reference be meant solely to the wellbeing of the given animal. "I think it will be obvious that the principle of final adaptation fails to satisfy all the conditions of the problem. That every segment, and almost every bone, which is present in the human hand and arm, should exist in the fin of the whale, solely because it is assumed they were required in such number and collocation for the movement of that undivided and inflexible paddle, squares as little with our idea of the simplest mode of effecting the purpose, as the reason which might be assigned for the greater number of bones in the cranium of the chick, viz., to allow the safe compression of the brain-case during the act of extrusion, squares with the requirements of that act." (Lecture

on Limbs, p. 40.) And again, (Homologies, p. 73,) "The attempt to explain by the Cuvierian principles the facts of special homology on the hypothesis of the subserviency of the parts so determined to similar ends in different animals—to say that the same or answerable bones occur in them because they have to perform similar functions—involves many difficulties, and is opposed by numerous phenomena. We may admit that the multiplied points of ossification in the skull of the human fœtus facilitate, and were designed to facilitate, child-birth; yet something more than such a final purpose lies beneath the fact, that most of those osseous centres represent permanently distinct bones in the cold-blooded vertebrates. The cranium of the bird, which is composed in the adult of a single bone, is ossified from the same number of points as in the human embryo, without the possibility of a similar purpose being subserved thereby in the extrication of the chick from the fractured egg-shell. The composite structure is repeated in the minute and prematurely born embryo of the marsupial quadrupeds. Moreover, in the bird and marsupial, as in the human subject, the different points of ossification have the same relative position and plan of arrangement as in the skull of the young crocodile, in which, as in most other reptiles, and in most fishes, the bones so commencing maintain throughout life their primitive distinctness. These, and a hundred such facts, force upon the contemplative anatomist the inadequacy of the teleological hypothesis."

While we admit all this, we do not think that he is justified in saying, "We feel the truth of Bacon's comparison of final causes to the vestal virgins, and feel that they would be barren and unproductive of the fruits we are labouring to attain, and would yield us no clue to the comprehension of that law of conformity of which we are in quest." His own favourite idea might, we think, have led the learned professor up from the *special* doctrine of final causes to a *general* doctrine. Just as there is an archetype or general plan in the structure of the skeleton, so there may be a general scheme of final causes to accomplish a higher end than the special adaptation. It is not difficult, as we conceive, to perceive the final cause of this grand homology of parts. While the special modifications, or adaptations, investigated so carefully by Cuvier, are intended to promote the well-being of the particular species of animal, the archetypal plan investigated by Owen is intended to make the animal comprehensible by the intelligent creation.

We are not willing, at this far advanced stage of our Article, to enter upon an analysis of the powers of the human mind, otherwise we could demonstrate that this general type is admirably suited to the nature of man's faculties. Man's original,

immediate, and fundamental knowledge is obtained, we believe, by sense-perception, self-consciousness, and other forms of intuition. Upon the materials thus furnished, the faculties of understanding operate in discovering relations between the objects which have become known by means of the faculties of direct intuition. And chief among these faculties, which perceive relations, is that of comparison, or of perceiving resemblances. We hold this to be the most useful of all the faculties of the understanding, whether for practical or scientific purposes. We see it actively operating in early life. The child is taught most effectively by signs and comparisons. In the simpler stages of society, mankind can be instructed in the knowledge of abstract truths only by symbols and parables. Hence we find most heathen religions becoming mythic, or explaining their mysteries by allegories or instructive incidents. Nay, God himself, knowing the nature of the creatures formed by him, has condescended, in the earlier revelations which he made of himself, to teach by symbol; and the greatest of all teachers taught the multitudes by parables. The great exemplar of the ancient philosophy, and the grand archetype of modern philosophy, were alike distinguished by their possessing this faculty in a high degree, and have both told us that man was best instructed by similitudes. "It is difficult," says the Guest in the Statesmen of Plato, "fully to exhibit greater things without the use of patterns," (παραδειγματα.) Lord Bacon, in more than one place, has expressed the sentiment, "As hieroglyphics preceded letters, so parables are older than arguments. And even now, if any one wishes to pour new light into any human intellect, and to do so expediently and pleasantly, he must proceed in the same way, and call in the assistance of parables."

Now, the homologies of nature are suited to this faculty in man, and it may be also to the same, or a similar but higher, faculty in the minds of higher intelligences. Without the repetition and correspondence of parts, man would have felt himself lost in the midst of God's works, and this because of their very profusion. It is by means of points of analogy that man is enabled practically to recognise, and scientifically to classify, the objects by which he is surrounded. The more obvious resemblances furnish us with our practical knowledge. It is by means of the more fixed points of resemblance that science is enabled to form its classifications. It is by the grand archetypes of nature that we are enabled to perceive unity in the midst of diversity, and dispose all the works of God into sublime groups. It is the prevalence of archetypal forms which imparts to nature its unchanging aspect, and gives us the stable in the midst of the unstable.

Plato seems to have pointed to these archetypes, and so to have bodied forth a great truth, without, however, perceiving its precise meaning, in his doctrine of ideas and patterns, (*ιδεαι και παραδειγματα.*) Not that we are willing to accept the doctrine as it seems to have been understood by Plato and stated by Aikenside:

> "There deep retired,
> In his unfathomed essence viewed the forms—
> The forms eternal of created things."

It is quite true that these archetypes existed prior to the particular objects which are accommodated to them. But then they have no existence independent of God—they are the creation of God's intelligence, and are just the plan after which all things are formed. These archetypes proceed from intelligence, and are suited to intelligence. The prevalence of them throughout long geological ages, and possibly also throughout many different worlds, seems to shew that they are to be observed by various orders of intelligent beings. In this we have a sufficient final cause for the existence of these typical forms, and Owen has developed unconsciously a teleology of a higher and more archetypal order than Cuvier. It is just because such archetypes exist in nature that Owen has been enabled to group the whole vertebrate race of animals into one grand system.

The time has now come, we think, when Natural Theology should admit that there is more in nature than a mere adaptation of means to serve an immediate object. It will not lose, but rather gain by this, inasmuch as it will thereby be furnished with a new argument, and that of a different genus from that derived from the mere adaptation of parts, in favour of the existence of a Divine intelligence. The prevalence of model forms shews that all things are after a predetermined pattern. We are farther inclined to think that this new doctrine just rising into sight, while it is fitted to give us a more profound view of the intelligence displayed in creation, also furnishes a new analogy between natural and revealed religion. Revealed religion has long been known to possess a typical system. Many in these later days have, we fear, been entertaining a suspicion of the whole typical system of the Word of God,—it has appeared to them so visionary; and this suspicion has been confirmed by the indiscriminate way in which the types have often been treated. Possibly some may be more reconciled to the Scripture system when they are led to discover an analogous system pervading the works of God. We think, too, that a comparison of the principles involved in both systems might enable us to

construct a philosophical, that is, an enlarged system of Scripture Typology.

By types we are not to understand mere prefigurations of a certain greater form, but certain forms all after one great model. A type in this sense may point to an archetype, but does not imply an antitype. It is in this enlarged sense of type and archetype that the words types and figures are used in the Scriptures. We are, in closing this Article, to trace the appearance and re-appearance of like forms throughout the supernatural dispensations of God. This prevalence of typical forms in the supernatural as in the natural economies is addressed to the principles of man's mind. We can conceive no other system furnishing such unity amid diversity, and such means of raising men's minds to the comprehension of grand and sublime truths.

It strikes us that the typical system runs through the whole Divine economy revealed in the Word. First, Adam is the type of man. He and his posterity are all of the same essential nature, possessing similar powers of intuition and understanding, of will and emotion, of conscience and free agency, and God acts towards them in the dispensations of grace as in the dispensations of nature, as being one. Then, from the time of the Fall, we have two different typical forms—the one after the seed of the serpent, the other after the seed of the woman. Henceforth there is a contest between the serpent and Him who is to destroy the power of the serpent, between the flesh and the Spirit, between the Church and the world. Two manner of people are now seen struggling in the womb of time—a Cain and an Abel, an Ishmael and an Isaac, an Esau and a Jacob, an Absalom and a Solomon—the older born after the flesh, and the younger born after the spirit. It is this, fully as much as even the harmony of its doctrines, which gives a unity to our religion in all ages, which enables the Christian to profit to this day by the teaching of the Old Testament, to sing to this day the song of Moses and the psalms of David, and to perceive and feel that there are the same contests now as then, the same contests in the heart, the same contests in the world, between the evil and the good principle, between the first or nature-born, and the second or grace-born. In short, there are now as there have ever been, but two men on our earth, typical, federal, or representative; the first man which is Adam, and the second man which is Christ. "And so it is written, The first man Adam was made a living soul, the last Adam was made a quickening spirit. Howbeit that was not first which is spiritual, but that which is natural; and afterward that which is spiritual. The first man is of the earth, earthy; the second man is the Lord from heaven."

Had our limits permitted, we might have shewn that there

appear from age to age certain great leading powers of the first or earthly form, distinguished for their boldness and the oppression which they exercise over the Church, such as Cain and Lamech, Ham and Nimrod, Egypt and Babylon. "They have consulted together with one consent: they are confederate against thee; the tabernacles of Edom and the Ishmaelites, of Moab and the Hagarenes, Gebal and Ammon and Amalek, with the inhabitants of Tyre; Assur also is joined with them; they have holpen the children of Lot." These are represented in Christian times by Gog and Magog and Babylon. But we must confine ourselves to the figures of the better type which appear and re-appear throughout successive ages.

The Old Testament types may be divided into three classes, typical ordinances, personages, and events. *First*, there is a number of ordinances, all more or less of the same general mould, all imparting substantially the same instruction, all pointing to guilt contracted, to God offended, to a propitiation provided, and to acceptance secured through this propitiation,—the four great cardinal truths of revealed religion as addressed to fallen man. There were sacrifices in which the offerer, placing his hand on the head of the animal, and devoting it to destruction in his room and stead, expressed symbolically his belief in these great saving truths. There was the tabernacle, with its people worshipping outside, and the shechinah which had to be sprinkled with blood in its innermost recesses, pointing to an offended God, but a God who was to be propitiated through the shedding of blood. *Secondly*, there were typical persons, such as Abel and Enoch, Noah and Abraham, Moses and Joshua, Samuel and David, Elijah and Elisha, shadowing the prophetical, priestly, and kingly offices of Christ. From the fall downward, there is a succession of personages with their individual differences, but all after a predetermined model, exhibiting certain features of character in as marked a manner as the Jewish race shews certain features of countenance. Then there are, *thirdly*, certain typical events exhibiting the same truths in a still more impressive form. There is the flood in which many perish, but a few—that is, eight—souls are saved in an ark symbolical of Christ. There is the destruction of Sodom, in which the inhabitants of the city perish, while Lot and his family are rescued by heavenly interposition. Most instructive of all, and therefore occupying the most important place, there is the deliverance from Egypt. The state of the Hebrews as bondmen, the deliverer raised up, the method of the deliverance in the midst of judgments, the deliverance itself and the wonderful journey to Canaan, with the provision made for the sustenance of the people, are as certainly anticipations of

a higher redemption as the fish and reptile's limbs are an anticipation of those of man. It is all true history, and yet it looks as if it were a parable written by some man of God for our instruction. We are trained in the training of the children of Israel, and by means of this discipline through which they were put, our representative faculty has supplied us with some of our clearest and liveliest, our most profound and comforting notions of the plan of redemption.

In all these we may observe the same two general truths, the principle of general homology with the principle of specific adaptation. These typical ordinances, persons, and events, are all after the same general plan, and exhibit the truths which the sinner most requires to know, and especially the person and work of the expected ONE, under interesting and instructive aspects. But they were all at the same time adapted with exquisite skill to the age and to the circumstances of which they formed a part. The ordinances, for instance, were appropriate worship on the part of those who were required to observe them, and in some cases subserved certain national and civil purposes. The persons who figure as types, were all the while doing a work for their own day, and were in most cases, we believe, unconscious that they bore a representative character. The events, too, were in most cases important links in the chain of Providence. But, just as the paddle of the whale serves its special purpose, but contains divisions not needful to its special purpose; just as the chick's head contains typical bones not needed in order to its extrusion from the egg—so the Old Testament ordinances, personages, and events, have an additional importance given them by their prefigurative character. Like the different species in the vegetable and animal kingdoms; like the same organs in the different species—they diverge on either side in order to suit a special purpose, but still they all retain a predetermined pattern. In human architecture, the portico, and the passage leading from it, have commonly a homology to the temple itself. It is the same in the temple of God. The gateway, and the pillars and the avenues of approach, are all after the same outline as the temple to which they form an entrance.

But we cannot dwell on these Old Testament types; we must refer for the farther discussion of them to the able and learned work of Mr. Fairbairn, on the Typology of Scripture. In referring to this treatise, it would be entirely out of place to offer any analysis of a work which has been for some years in the hands of the public, and which has already taken its place among our standard theological literature. It is saying but little of it, to affirm that it is the best book with which we are acquainted on the subject of typology; for we know of no other work in which

the topic is treated in a manner at once evangelical and judicious, with learning, and yet with soundness in the faith. In the first volume the author clears the ground, enunciates his definitions, explains his principles, and presents a pretty full discussion of the Patriarchal period. In the second volume he treats of the Mosaic period, and develops his view of the true signification of the Exodus from Egypt, and the Law as delivered from Sinai.

We like, particularly, the opening chapters, in which the learned author lays down his principles, which seem to us in many respects original, and generally judicious. His orbit and ours do not lie exactly in the same plane, and there are one or two points at which we might cross each other, but, upon the whole, we very much coincide both with his principles and the application which he has made of them.

"If we inquire concerning these resemblances, of what kind or nature they behoved to be, and actually were, a very little reflection must convince us, that they must somehow have exhibited the same great elements of truth with the things they represented, and that too in a form more level to the comprehension, more easily and distinctly cognizable by the minds of men. There must have been, first of all, the same great elements of truth,—for the mind of God and the circumstances of the fallen creature are substantially the same at all times. What the spiritual necessities of men now are, they have been from the time that sin entered into the world. Hence the truth revealed by God to meet these necessities, however varying from time to time in the precise amount of its communications, and however as to the hue and form in which it might be presented, must have been, so far as disclosed, essentially one in every age. . . . But then, as the full-grown man, when pursuing the tenor of his way through the perplexing snares and busy avocations, reaps every day the benefit of his early culture, so, doubtless, it was the intention of God that the measures adopted with the ancient Church should not only minister to the growing light and comfort of its own members, but also furnish materials of consolation, guidance, and improvement to the Church of the New Testament."

But to return to our own theme, for it will be observed that while Mr. Fairbairn treats of types in the theological sense, or of prefigurations of Christ, we treat of types in the larger, and, we believe, scriptural sense, as model or pattern figures. (*Τύποι καὶ ὑποδείγματα*; see 1 Cor. x. 6; Phil. iii. 17; 1 Peter v. 3.) Under the Old Testament the shadow becomes more and more defined as the substance draws nigh, till in the later prophets we have a complete anticipation. The figure, indeed, as presented in the first prediction, is as large as it ever is afterwards, but its lines come out more and more distinctly as we approach

the fulness of time. The doctrine which we are expounding, be it observed, is not the vulgar one of type and antitype, but that of typical forms, serving most important purposes in the age in which they appear; but, at the same time, epitomes of an archetype to appear. When the archetype appears, what had been seen before merely as shadow, now comes forth clearly. The older saints had merely the shadow—but we, with open face, looking into the New Testament as into a glass, see the very image, (Heb. x. 1; 2 Cor. iii. 18.) In the scene on Calvary, in particular, we have the truths which the sinner is most concerned to know, of sin and salvation, of God offended, and God pacified, set forth in the most awfully, and yet most winningly, impressive manner.

Nor does the scheme of types, as now explained, cease on the appearance of Christ. We still live under a system of types. Just as all the figures in the Old Testament look forward to him who is the principal figure, so do the figures in the New Testament look back to him. But there is this difference between the former and the latter types, that the latter, as becometh the dispensation, are not so much outward and ceremonial as inward and spiritual. The miracles wrought by Christ in person, when on the earth, are typical of the supernatural power which he is exercising by his Spirit; the healing of diseases is representative of his power to cure spiritual maladies. There is a close mystical union between him and each of his people—he and they are said to be one. They are one in respect of their human nature. "It behoved him to be made like unto his brethren; and forasmuch as the children are partakers of flesh and blood, he also likewise took part of the same," and "took on him not the nature of angels but the seed of Abraham." Then he is their surety and representative, and they are reckoned as righteous in him. He stood in their place guilty, "stricken, smitten of God," and they stand in his room accepted, righteous. He has become, too, "the head of the body, the Church," "the beginning, the first-born from the dead," and "has in all things the pre-eminence and is the first-born among many brethren." They are priests under him as chief-priest, kings under him as sovereign. By his appointment they are "predestinated to be conformed to his image." The Godhead once more issues the decree in reference to this man and that man, "let us make man in our image after our likeness;" "so God creates man in his own image, in the likeness of God creates he him." In the performance of this work they are "crucified together with him," "dead with him," "buried with him," and as they die with him, so they "rise with him," and "reign with him." In this household there are many children, and there are differences between

them of gift and taste to suit them for the different employments to be allotted to them; but still, we may discern in them all a family likeness, for they are all begotten of God. In this perfect system of types the whole has a representative in every part, and every part is a symbol of the whole. Each living stone in this temple is carved after the similitude of the whole temple. Each leaf, each branch of this tree of life is an image of the whole tree. The Church is his body, and every member in particular is after the pattern of the whole body.

When objects become far removed from us, we must be on our guard against taking clouds for realities, but we think we see some real truths—lying we grant—on the very horizon of our vision. All animal bodies, as we have seen, point to man as the top of the earthly hierarchy. Professor Owen tells us that "all the parts and organs of man had been sketched out in anticipation, so to speak, in the inferior animals;" and that "the recognition of an ideal exemplar in the vertebrated animals proves that the knowledge of such a being as man must have existed before man appeared. For the Divine mind which planned the archetype, also foreknew all its modifications. The archetypal idea was manifested in the flesh long prior to the existence of those animal species that actually exemplify it. To what natural laws or secondary causes the orderly succession and progression of such organic phenomena may have been committed, we as yet are ignorant. But if, without derogation of the Divine power, we may conceive the existence of such ministers, and personify them by the term 'Nature,' we learn from the past history of our globe, that she has advanced with slow and stately steps, guided by the archetypal light amidst the wreck of worlds, from the first embodiment of the vertebrate idea under its old ichthyic vestment, until it became arrayed in the glorious garb of the human form."

But may not this highest form on earth point to a still higher form? Man's body on earth may be but a prefiguration of his body in heaven. "But some will say, how are the dead raised up, and with what body do they come?" The Apostle does not give a direct answer to this question, but he points to certain analogies which shew that though the body will preserve its identity, it will be changed to a nobler form, as the seed is changed when it becomes grain. "It is sown a natural body, it is raised a spiritual body; for there is a natural body and a spiritual body, and we read of bodies terrestrial and of bodies celestial." In heaven then our bodies are to be after a higher model, "spiritual" and "celestial." It doth not, indeed, appear what we shall be, but when He appears we shall be like Him, and our bodies fashioned after his spiritual body, which we may

believe to be the most sublimated form of matter—and modern science, while it cannot efface the distinction between mind and matter, is every day enlarging our conceptions of the capacities of matter. Thus the simplest organism, points by its structure upwards to man, and man's earthly frame points to his heavenly frame, and his heavenly frame points to Christ's glorious body, and we see that all animated things on earth point onward to His glorified humanity as the Grand Archetype of all that has life.

Professor Owen has another idea. He supposes that in other worlds, as there are the same laws of light and gravitation as on our earth, there may be also a similar organic structure. "And the inference as to the possibility of the vertebrate type being the basis of the organization of some of the inhabitants of other planets, will not appear so hazardous, when it is remembered that the orbits or protective cavities of the eyes of the vertebrata of this planet are constructed of modified vertebræ. Our thoughts are free to soar as far as any legitimate analogy may seem to guide them rightly in the boundless ocean of unknown truth. But if censure be merited for here indulging, even for a moment, in pure speculation, it may, perhaps, be disarmed by the reflection that the discovery of the vertebrate archetype could not fail to suggest to the anatomist many possible modifications of it beyond those that we know to have been realized in this little orb of ours."

If there be any truth in this idea, then the animated matter of other worlds may point to the same Archetype as the animated matter of this world. And on this supposition what a significancy would be given to the humanity of Christ. When the Word became flesh, the Divinity was in a sense humbled; and when the Incarnate Word ascended into heaven, flesh or matter was exalted and made to serve the highest purposes. We thus obtain a glimpse of a way in which matter throughout all its domains may be exalted by its association with the Son of God taking our likeness; and of a way, too, in which other worlds or all worlds, and other creatures, even principalities and powers in heavenly places, may be instructed by this "manifold wisdom," and by which God may "by him reconcile all things unto himself; by him, I say, whether they be things in earth or things in heaven."

But as we stand gazing on our ascending Lord, a cloud wraps him from our view, and we hear as it were a voice, saying, "Why stand ye here gazing?" and bidding us return to the observation of objects on the earth clearly within the range of our vision.