PARTICULAR CONSIDERATIONS

RESPECTING

THE ORIGIN OF THE ANIMATED TRIBES.

THE general likelihood of an organic creation by law having been shewn, we are next to inquire if science has any facts tending to bring the assumption more nearly home to nature. Such facts there certainly are; but it cannot be surprising that they are comparatively few and scattered, when we consider that the inquiry is into one of nature's profoundest mysteries, and one which has hitherto engaged no direct attention in almost any quarter.

Crystallization is confessedly a phenomenon of inorganic matter; yet the simplest rustic observer is struck by the resemblance which the examples of it left upon a window by frost bear to vegetable forms. In some crystallizations the mimicry is

beautiful and complete; for example, in the well-known one called the *Arbor Dianæ.* An amalgam of four parts of silver and two of mercury being dissolved in nitric acid, and water equal to thirty weights of the metals being added, a small piece of soft amalgam of silver suspended in the solution, quickly gathers to itself the particles of the silver of the amalgam, which form upon it a *crystallization precisely resembling a shrub.* The experiment may be varied in a way which serves better to detect the influence of electricity in such operations, as noted below.* Vegetable figures are also presented in some of the most ordinary appear-

* "A glass tube is to be bent into a syphon, and placed with the curve downwards, and in the bend is to be placed a small portion of mercury, not sufficient to close the connexion between the two legs; a solution of nitrate of silver is then to be introduced until it rises in both limbs of the tube. The precipitation of the mercury, in the form of an Arbor Dianæ, will then take place, slowly, only when the syphon is placed in a plane perpendicular to the magnetic meridian; but if it be placed in a plane coinciding with the magnetic meridian, the action is rapid, and the crystallization particularly beautiful, taking place principally in that branch of the syphon towards the north. If the syphon be placed in a plane perpendicular to the magnetic meridian, and a strong magnet brought near it, the precipitation will commence in a short time, and be most copious in the branch of the syphon nearest to the south pole of the magnet."

ances of the electric fluid. In the marks caused by positive electricity, or which it leaves in its passage, we see the ramifications of a tree, as well as of its individual leaves; those of the negative, recal the bulbous or the spreading root, according as they are clumped or divergent. These phenomena seem to say that the electric energies have had something to do in determining the forms of plants. That they are intimately connected with vegetable life is indubitable, for germination will not proceed in water charged with negative electricity, while water charged positively greatly favours it; and a garden sensibly increases in luxuriance, when a number of conducting rods are made to terminate in branches over its beds. With regard to the resemblance of the ramifications of the branches and leaves of plants to the traces of the positive electricity, and that of the roots to the negative, it is a circumstance calling for especial remark, that the atmosphere, particularly its lower strata, is generally charged positively, while the earth is always charged negatively. The correspondence here is curious. A plant thus appears as a thing formed on the basis of a natural electrical operation—*the brush* realized.

We can thus suppose the various forms of plants as, immediately, the result of a law in electricity variously affecting them according to their organic character, or respective germinal constituents. In the poplar, the brush is unusually vertical, and little divergent; the reverse in the beech: in the palm, a pencil has proceeded straight up for a certain distance, radiates there, and turns outwards and downwards; and so on. We can here see at least traces of secondary means by which the Almighty Deviser might establish all the vegetable forms with which the earth is overspread.

Vegetable and animal bodies are mainly composed of the same four simple substances or elements—carbon, oxygen, hydrogen, and nitrogen. The first combinations of these in animals are into what are called proximate principles, as albumen, fibrin, urea, alantoin, &c., out of which the structure of the animal body is composed. Now the chemist, by the association of two parts oxygen, four hydrogen, two carbon, and two nitrogen, can *make urea*. Alantoin has also been produced artificially. Two of the proximate principles being realizable by human care, the possibility of realizing or forming all is established. Thus the chemist may be said to have it in his power to realize the

first step in organization.* Indeed, it is fully acknowledged by Dr. Daubeny, that in the combinations forming the proximate principles there is no chemical peculiarity. "It is now certain," he says, "that the same simple laws of composition pervade the whole creation; and that, if the organic chemist only takes the requisite precautions to avoid resolving into their ultimate elements the proximate principles upon which he operates, the results of his analysis will shew that they are combined precisely according to the same plan as the elements of mineral bodies are known to be."† A particular fact is here worthy of attention. "The conversion of fecula into sugar, as one of the ordinary processes of vegetable economy, is effected by the production of a secretion termed *diastose*, which occasions both the rupture of the starch vesicles, and the change of their contained gum into sugar. This diastose may be separately obtained by the chemist, and it acts as effectually in his laboratory as in the vegetable organization.

* Fatty matter has also been formed in the laboratory. The process consisted in passing a mixture of carbonic acid, pure hydrogen, and carburetted hydrogen, in the proportion of one measure of the first, twenty of the second, and ten of the third, through a red-hot tube.

† Supplement to the Atomic Theory.

He can also imitate its effects by other chemical agents."* The writer quoted below adds, "No reasonable ground has yet been adduced for supposing that, if we had the power of bringing together the elements of any organic compound, in their requisite states and proportions, the result would be any other than that which is found in the living body."

It is much to know the elements out of which organic bodies are composed. It is something more to know their first combinations, and that these are simply chemical. How these combinations are associated in the structure of living bodies is the next inquiry, but it is one to which as yet no satisfactory answer can be given. The investigation of the minutiæ of organic structure by the microscope is of such recent origin, that its results cannot be expected to be very clear. Some facts, however, are worthy of attention with regard to the present inquiry. It is ascertained that the basis of all vegetable and animal substances consists of nucleated cells; that is, cells having granules within them. Nutriment is converted into these before being assimilated by the system. The tissues are formed from them. The ovum

* Carpenter on Life; Todd's Cyclopædia of Physiology.

destined to become a new creature, is originally only a cell with a contained granule. We see it acting this reproductive part in the simplest manner in the cryptogamic plants. "The parent cell, arrived at maturity by the exercise of its organic functions, bursts, and liberates its contained granules. These, at once thrown upon their own resources, and entirely dependent for their nutrition on the surrounding elements, develop themselves into new cells, which repeat the life of their original. Amongst the higher tribes of the cryptogamia, the reproductive cell does not burst, but the first cells of the new structure are developed within it, and these gradually extend, by a similar process of multiplication, into that primary leaf-like expansion which is the first formed structure in all plants."* *Here the little cell becomes directly a plant, the full formed living being.* It is also worthy of remark that, in the sponges, (an animal form,) a gemmule detached from the body of the parent, and trusting for sustentation only to the fluid into which it has been cast, becomes, without further process, the new creature. Further, it has been recently discovered by means of the micro-

* Carpenter's Report on the results obtained by the Microscope in the Study of Anatomy and Physiology, 1843.

scope, that there is, as far as can be judged, a perfect resemblance between the ovum of the mammal tribes, during that early stage when it is passing through the oviduct, and the young of the infusory animalcules. One of the most remarkable of these, the *volvox globator*, has exactly the form of the germ which, after passing through a long fœtal progress, becomes a complete mammifer, an animal of the highest class. It has even been found that both are alike provided with those *cilia*, which, producing a revolving motion, or its appearance, is partly the cause of the name given to this animalcule. These resemblances are the more entitled to notice, that they were made by various observers, distant from each other at the time.* It has likewise been noted that the globules of the blood are reproduced by the expansion of contained granules; they are, in short, *distinct organisms multiplied by the same fissiparous generation.* So that all animated nature may be said to be based on this mode of origin; *the fundamental form of organic being is a globule, having a new globule forming within itself*, by which it is in time

* See Dr. Martin Barry on Fissiparous Generation; Jameson's Journal, Oct. 1843. Appearances precisely similar have been detected in the germs of the crustacea.

discharged, and which is again followed by another and another, in endless succession. It is of course obvious that, if these globules could be produced by any process from inorganic elements, we should be entitled to say that the fact of a transit from the inorganic into the organic had been witnessed in that instance; the possibility of the commencement of animated creation by the ordinary laws of nature might be considered as established. Now it was given out some years ago by a French physiologist, that *globules could be produced in albumen by electricity.* If, therefore, these globules be identical with the cells which are now held to be reproductive, it might be said that the production of albumen by artificial means is the only step in the process wanting. This has not yet been effected; but it is known to be only a chemical process, the mode of which may be any day discovered in the laboratory, and two compounds perfectly co-ordinate, urea and alantoin, have actually been produced.

In such an investigation as the present, it is not unworthy of notice that the production of shell is a natural operation which can be precisely imitated artificially. Such an incrustation takes place on both the outside and inside of the wheel in a

bleaching establishment, in which cotton cloth is rinsed free of the lime employed in its purification. From the *dressing* employed by the weaver, the cloth obtains the animal matter, *gelatin;* this and the lime form the constituents of the incrustation, exactly as in natural shell. In the wheel employed at Catrine, in Ayrshire, where the phenomenon was first observed by the eye of science, it had required ten years to produce a coating the tenth of an inch in thickness. This incrustation has all the characters of shell, displaying a highly polished surface, beautifully iridescent, and, when broken, a foliated texture. The examination of it has even thrown some light on the character and mode of formation of natural shell. "The plates into which the substance is divisible have been formed in succession, and certain intervals of time have elapsed between their formation; in general, every two contiguous laminæ are separated by a thin iridescent film, varying from the three to the fifty millionth part of an inch in thickness, and producing all the various colours of thin plates which correspond to intermediate thicknesses: between some of the laminæ no such film exists, probably in consequence of the interval of time between their formation being too short; and between

others the film has been formed of unequal thickness. There can be no doubt that these iridescent films are formed when the dash-wheel is at rest during the night, and that when no film exists between two laminæ, an interval too short for its formation, (arising, perhaps, from the stopping of the work during the day,) has elapsed during the drying or induration of one lamina and the deposition of another."* From this it has been deduced, by a patient investigation, that those colours of mother-of-pearl, which are incommunicable to wax, arise from iridescent films deposited between the laminæ of its structure, and it is hence inferred that *the animal*, like the wheel, *rests periodically from its labours in forming the natural substance.*

These, it will be owned, are curious and not irrelevant facts; but it will be asked what actual experience says respecting the origination of life. Are there, it will be said, any authentic instances of either plants or animals, of however humble and simple a kind, having come into existence otherwise than in the ordinary way of generation, since the time of which geology forms the record? It

* Mr. Leonard Horner and Sir David Brewster, on a substance resembling shell.—*Philosophical Transactions*, 1836.

may be answered, that the negative of this question could not be by any means formidable to the doctrine of law-creation, seeing that the conditions necessary for the operation of the supposed life-creating laws may not have existed within record to any great extent. On the other hand, as we see the physical laws of early times still acting with more or less force, it might not be unreasonable to expect that we should still see some remnants, or partial and occasional workings of the life-creating energy amidst a system of things generally stable and at rest. Are there, then, any such remnants to be traced in our own day, or during man's existence upon earth? If there be, it clearly would form a strong evidence in favour of the doctrine, as what now takes place upon a confined scale and in a comparatively casual manner may have formerly taken place on a great scale, and as the proper and eternity-destined means of supplying a vacant globe with suitable tenants. It will at the same time be observed that, the earth being now supplied with both kinds of tenants in great abundance, we only could expect to find the life-originating power at work in some very special and extraordinary circumstances, and

probably only in the inferior and obscurer departments of the vegetable and animal kingdoms.

Perhaps, if the question were asked of ten men of approved reputation in science, nine out of the number would answer in the negative. This is because, in a great number of instances where the superficial observers of former times assumed a non-generative origin for life, (as in the celebrated case in Virgil's fourth Georgic,) either the direct contrary has been ascertained, or exhaustive experiments have left no alternative from the conclusion that ordinary generation did take place, albeit in a manner which escapes observation. Finding that an erroneous assumption has been formed in many cases, modern inquirers have not hesitated to assume that there can be no case in which generation is not concerned; an assumption not only unwarranted by, but directly opposed to, the principles of philosophical investigation. Yet this is truly the point at which the question now rests in the scientific world.

I have no wish here to enter largely into a subject so wide and so full of difficulties; but I may remark, that the explanations usually suggested where life takes its rise without apparent generative means,

always appear to me to partake much of the fallacy of the *petitio principii*. When, for instance, lime is laid down upon a piece of waste moss ground, and a crop of white clover for which no seeds were sown is the consequence, the explanation that the seeds have been dormant there for an unknown time, and were stimulated into germination when the lime produced the appropriate circumstances, appears extremely unsatisfactory, especially when we know that (as in an authentic case under my notice) the spot is many miles from where clover is cultivated, and that there is nothing for six feet below but pure peat moss, clover seeds being, moreover, known to be too heavy to be transported, as many other seeds are, by the winds. Mushrooms, we know, can be propagated by their seed; but another mode of raising them, well known to the gardener, is to mix cow and horse dung together, and thus form a bed in which they are expected to grow without any seed being planted. It is assumed that the seeds are carried by the atmosphere, unperceived by us, and, finding here an appropriate field for germination, germinate accordingly; but this is only assumption, and though designed to be on the side of a severe philosophy, in reality makes a pretty large demand on credu-

lity. There are several persons eminent in science who profess at least to find great difficulties in accepting the doctrine of invariable generation. One of these, in the work noted below,* has stated several considerations arising from analogical reasoning, which appear to him to throw the balance of evidence in favour of the aboriginal production of infusoria,† the vegetation called mould, and the like. One seems to be of great force; namely, that the animalcules, which are supposed (altogether hypothetically) to be produced by ova, are afterwards found increasing their numbers, not by that mode at all, but by division of their bodies. If it be the nature of these creatures to propagate in this splitting or fissiparous manner, how could they be communicated to a vegetable infusion? Another fact of very high importance is presented in the following terms:—"The nature of the animalcule, or vegetable production, bears a constant relation to the state of the infusion, so that, in similar circumstances, the same are always produced without this being influenced by the atmosphere. There

* Dr. Allen Thomson, in the article *Generation*, in Todd's Cyclopædia of Anatomy and Physiology.

† The term aboriginal is here suggested, as more correct than spontaneous, the one hitherto generally used.

seems to be a certain *progressive advance in the productive powers of the infusion,* for at the first the animalcules are only of the smaller kinds, or monades, and afterwards *they become gradually larger and more complicated in their structure; after a time, the production ceases, although the materials are by no means exhausted.* When the quantity of water is very small, and the organic matter abundant, the production is usually of a vegetable nature; when there is much water, animalcules are more frequently produced." It has been shewn by the opponents of this theory, that when a vegetable infusion is debarred from the contact of the atmosphere, by being closely sealed up or covered with a layer of oil, no animalcules are produced; but it has been said, on the other hand, that the exclusion of the air may prevent some simple condition necessary for the aboriginal development of life—and nothing is more likely. Perhaps the prevailing doctrine is in nothing placed in greater difficulties than it is with regard to the entozoa, or creatures which live within the bodies of others. These creatures do, and apparently can, live nowhere else than in the interior of other living bodies, where they generally take up their abode in the viscera, but also sometimes in the chambers

of the eye, the interior of the brain, the serous sacs, and other places having no communication from without. Some are viviparous, others oviparous. Of the latter it cannot reasonably be supposed that the ova ever pass through the medium of the air, or through the blood-vessels, for they are too heavy for the one transit, and too large for the other. Of the former, it cannot be conceived how they pass into young animals—certainly not by communication from the parent, for it has often been found that entozoa do not appear in certain generations, and some of peculiar and noted character have only appeared at rare intervals, and in very extraordinary circumstances. A candid view of the less popular doctrine, as to the origin of this humble form of life, is taken by a distinguished living naturalist. "To explain the beginning of these worms within the human body, on the common doctrine that all created beings proceed from their likes, or a primordial egg, is so difficult, that the moderns have been driven to speculate, as our fathers did, on their spontaneous birth; but they have received the hypothesis with some modification. Thus it is not from putrefaction or fermentation that the entozoa are born, for both of these processes are rather fatal to their existence,

but from the aggregation and fit apposition of matter which is already organized, or has been thrown from organized surfaces. * * Their origin in this manner is not more wonderful or more inexplicable than that of many of the inferior animals from sections of themselves. * * Particles of matter fitted by digestion, and their transmission through a living body, for immediate assimilation with it, or flakes of lymph detached from surfaces already organized, seem neither to exceed nor fall below that simplicity of structure which favours this wonderful development; and the supposition that, like morsels of a planaria, they may also, when retained in contact with living parts, and in other favourable circumstances, continue to live and be gradually changed into creatures of analogous conformation, is surely not so absurd as to be brought into comparison with the Metamorphoses of Ovid. * * We think the hypothesis is also supported in some degree by the fact, that the origin of the entozoa is favoured by all causes which tend to disturb the equality between the secerning and absorbent systems."* Here particles of organized matter are suggested as the germinal origin of distinct and

* Article "Zoophytes," Encyclopædia Britannica, 7th edition.

fully organized animals, many of which have a highly developed reproductive system. How near such particles must be to the inorganic form of matter may be judged from what has been said within the last few pages. If, then, this view of the production of entozoa be received, it must be held as in no small degree favourable to the general doctrine of an organic creation by law.

There is another series of facts, akin to the above, and which deserve not less attention. The pig, in its domestic state, is subject to the attacks of a hydatid, from which the wild animal is free; hence the disease called measles in pork. The domestication of the pig is of course an event subsequent to the origin of man; indeed, comparatively speaking, a recent event. Whence, then, the first progenitor of this hydatid? So also there is a tinea which attacks dressed wool, but never touches it in its unwashed state. A particular insect disdains all food but chocolate, and the larva of the *oinopota cellaris* lives nowhere but in wine and beer, all of these being articles manufactured by man. There is likewise a creature called the *pimelodes cyclopum*, which is only found in subterranean cavities connected with certain specimens of the volcanic formation in South

America, dating from a time posterior to the arrangements of the earth for our species. Whence the first pymelodes cyclopum? Will it, to a geologist, appear irrational to suppose that, just as the pterodactyle was added in the era of the new red sandstone, when the earth had become suited for such a creature, so may these creatures have been added when media suitable for their existence arose, and that such phenomena may take place any day, the only cause for their taking place seldom being the rarity of the rise of new physical conditions on a globe which seems to have already undergone the principal part of its destined mutations?

Between such isolated facts and the greater changes which attended various geological eras, it is not easy to see any difference, besides simply that of the scale on which the respective phenomena took place, as the throwing off of one copy from an engraved plate is exactly the same process as that by which a thousand are thrown off. Nothing is more easy to conceive than that to Creative Providence, the numbers of such phenomena, the time when, and the circumstances under which they take place, are indifferent matters. The Eternal One has arranged for everything

beforehand, and trusted all to the operation of the laws of his appointment, himself being ever present in all things. We can even conceive that man, in his many doings upon the surface of the earth, may occasionally, without his being aware of it, or otherwise, act as an instrument in preparing the association of conditions under which the creative laws work; and perhaps some instances of his having acted as such an instrument have actually occurred in our own time.

I allude, of course, to the experiments conducted a few years ago by Mr. Crosse, which seemed to result in the production of a heretofore unknown species of insect in considerable numbers. Various causes have prevented these experiments and their results from receiving candid treatment, but they may perhaps be yet found to have opened up a new and most interesting chapter of nature's mysteries. Mr. Crosse was pursuing some experiments in crystallization, causing a powerful voltaic battery to operate upon a saturated solution of silicate of potash, when the insects unexpectedly made their appearance. He afterwards tried nitrate of copper, which is a deadly poison, and from that fluid also did live insects emerge. Discouraged by the reception of his experiments,

Mr. Crosse soon discontinued them; but they were some years after pursued by Mr. Weekes, of Sandwich, with precisely the same results. This gentleman, besides trying the first of the above substances, employed ferro-cyanet of potash, on account of its containing a larger proportion of carbon, the principal element of organic bodies; and from this substance the insects were produced *in increased numbers.* A few weeks sufficed for this experiment, with the powerful battery of Mr. Crosse; but the first attempts of Mr. Weekes required about eleven months, a ground of presumption in itself that the electricity was chiefly concerned in the phenomenon. The changes undergone by the fluid operated upon, were in both cases remarkable, and nearly alike. In Mr. Weekes' apparatus, the silicate of potash became first turbid, then of a milky appearance; round the negative wire of the battery, dipped into the fluid, there gathered a quantity of *gelatinous matter,* a part of the process of considerable importance, considering that gelatin is one of the *proximate principles,* or first compounds, of which animal bodies are formed. From this matter Mr. Weekes observed one of the insects in the very act of emerging, immediately after which, it ascended

to the surface of the fluid, and sought concealment in an obscure corner of the apparatus. The insects produced by both experimentalists seem to have been the same, a species of acarus, minute and semi-transparent, and furnished with long bristles, which can only be seen by the aid of the microscope. It is worthy of remark, that some of these insects, soon after their existence had commenced, were found to be likely to extend their species. They were sometimes observed to go back to the fluid to feed, and occasionally they devoured each other.*

The reception of novelties in science must ever be regulated very much by the amount of kindred or relative phenomena which the public mind already possesses and acknowledges, to which the new can be assimilated. A novelty, however true, if there be no received truths with which it can be shewn in harmonious relation, has little chance of a favourable hearing. In fact, as has been often observed, there is a measure of incredulity from our ignorance as well as from our knowledge, and if the most distinguished philosopher three hundred years ago had ventured to develop any striking new fact which only could

* See a pamphlet circulated by Mr. Weekes, in 1842.

harmonize with the as yet unknown Copernican solar system, we cannot doubt that it would have been universally scoffed at in the scientific world, such as it then was, or at the best interpreted in a thousand wrong ways in conformity with ideas already familiar. The experiments above described, finding a public mind which had never discovered a fact or conceived an idea at all analogous, were of course ungraciously received. It was held to be impious, even to surmise that animals could have been formed through any instrumentality of an apparatus devised by human skill. The more likely account of the phenomena was said to be, that the insects were only developed from ova, resting either in the fluid, or in the wooden frame on which the experiments took place. On these objections the following remarks may be made. The supposition of impiety arises from an entire misconception of what is implied by an aboriginal creation of insects. The experimentalist could never be considered as the author of the existence of these creatures, except by the most unreasoning ignorance. The utmost that can be claimed for, or imputed to him is that he arranged the natural conditions under which the true creative energy—that of the Divine

Author of all things—was pleased to work in that instance. On the hypothesis here brought forward, the *acarus Crossii* was a type of being ordained from the beginning, and destined to be realized under certain physical conditions. When a human hand brought these conditions into the proper arrangement, it did an act akin to hundreds of familiar ones which we execute every day, and which are followed by natural results; but it did nothing more. The production of the insect, if it did take place as assumed, was as clearly an act of the Almighty himself, as if he had fashioned it with hands. For the presumption that an act of aboriginal creation did take place, there is this to be said, that, in Mr. Weekes's experiment, every care that ingenuity could devise was taken to exclude the possibility of a development of the insects from ova. The wood of the frame was baked in a powerful heat; a bell-shaped glass covered the apparatus, and from this the atmosphere was excluded by the constantly rising fumes from the liquid, for the emission of which there was an aperture so arranged at the top of the glass, that only these fumes could pass. The water was distilled, and the substance of the silicate had been subjected to white heat. Thus every source of

fallacy seemed to be shut up. In such circumstances, a candid mind, which sees nothing either impious or unphilosophical in the idea of a new creation, will be disposed to think that there is less difficulty in believing in such a creation having actually taken place, than in believing that, in two instances, separated in place and time, exactly the same insects should have chanced to arise from concealed ova, and these a species heretofore unknown.