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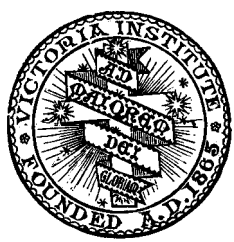

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diverge a little, and on doing so we find ourselves in the presence of rocks that are called Devonian, consisting principally of reddish-coloured limestones, slates, and shales, such as are found in the neighbourhood of Torquay and North Devon, and which extend into Cornwall. This is the Devonian strata, and below the Devonian we still pursue our way, across country, right into Wales, where we find a vast heaping up of mountain chains and other formations which are known as the Silurian, all still sloping inwards. Below these, again, we have an even grander mass of rocks called the Cambrian, and, dispersed amidst these, both, the Silurian and the Cambrian, exhibit also volcanic matter. The interpretation of this state of things must, of course, be, that each of these formations (proceeding westward), is beneath the other. I shall have to deal with four of these groups particularly, and, consequently, I have left out the minor layers, or strata, as not having anything to do with the subject of this paper. This brings me to that which I have put before you in the form of printed matter, and here I have to begin in a backward direction from that in which we have already travelled from London. We begin in fact where we just now left off, namely with the great Cambrian rocks :—

PEDIGREE OF THE CORAL-REEFS OF ENGLAND.

By S. R. PATTISON, F.G.S.

WE propose to refer to the principal reefs of fossil coral in England, and examine their contents, and read the lessons they teach on the subject of Evolution.

CAMBRIAN ROCKS.

The fine hilly district which stretches from the Irish Channel to the hills of the Welsh border, is principally composed of coarse slaty rocks, which were named Cambrian by the veteran geological chieftain, Professor Sedgwick. In these we find a few fossil corals, and abundant remains of creatures classed by naturalists as Hydroids and Bryozoa (or moss animals), but no reef builders.

These Hydroids are the lowest corals, and Bryozoa are the lowest tribe of Molluscs. The former are lower by one step than the corals proper, and are so numerous in some of the Cambrian strata that whole floors and beds of limestone have resulted from their decay, although the creatures are individually extremely minute (Graptolites). They are of the same class as the true corals; yet no one who

observes the structure of both could for a moment consider the one as the progenitor of the other.

Silurians.

Travelling thence eastwards, and passing the great volcanic region of Snowdonia, we find ourselves in a mountainous country of slate and sandstone, which was the theatre of the wanderings and wars of the ancient Silures, who contested the Roman advance. Sir Roderick Murchison, the explorer of this district, named the prevalent system of rock here, Silurian, and the appellation, having been found convenient, has been applied to rocks of the same kind all over the world.

Extending our journey towards Shrewsbury, through Wenlock, the traveller has by his side, for about thirty miles, a ridge of hills remarkably uniform, showing, wherever opened, limestone rock. On visiting any one of the numerous quarries on this hillside, the limestone is seen to be principally composed of rough blocks of fossil coral, embedded in shale and limestone. A very short study convinces the beholder that he is on a coral-reef of the old ocean, and that its growth and aspect must have been altogether like the description given of the great live reefs now existing in the Pacific Ocean. There are 102 specimens of corals in these strata, of which the more numerous belong to the genera *Favosites* (honeycomb coral), and *Halysites* (sea-stone, of which the chain-coral is well known), *Monticulipora* (little-mound pores), and *Syringopora* (pipe-pores). All these forms are absolutely unknown to any preceding platform of life in the geological scale; they burst at once on the stage. There are no traces of direct ancestors, nor shall we find, as we ascend, that they leave any successors displaying their exact form and fashion.

Many genera of creatures are the same as in the succeeding rocks; but not one species. We can, however, perceive at a glance, that the old corals were as large, beautiful, and elaborate as any of the modern ones.

Whence came these curious creatures, or rather tribes? Were they emigrants? There is no evidence of this. Were they descendants of any previous form? The facts forbid the assumption. Like Minerva springing from the head of Jupiter, they rise up fully armed *cap à pied*.

Devonians.

Diverging southwards on our journey—or, rather voyage across ancient oceans—we come to the rich marbled rocks cut

through by the South Devon Railway. These are seen in the ascent westward from Newton Abbot; and, spreading out, they form the exquisite bay of Babbicombe and the headlands and heights of Torquay. They display great beds of coralline stone, which furnish the workers of the district with beautifully-veined "Devonshire Marble."

There are found here about fifty-two specimens of corals, and they all exclusively belong to this epoch of life; not one of them is to be seen in the preceding Silurian, and not one of them passes into the subsequent Carboniferous strata.

Mountain-Limestone Reefs.

Again setting sail, we soon arrive at another reef. It might reasonably have been expected that the shallow islands on which grew the tropical vegetation now forming our coal-beds would be accompanied seaward by corals, which would assimilate them to the islands of the Northern Pacific. This is the case. Thus we have an interrupted reef extending from Somersetshire to Northumberland, along the line of which coralline strata are inter-stratified with shales (compressed mud), and grits (compressed sand).

The common corals of the great coal-limestone are *Lithostrotion, Lithodendron, Syringopora, Lonsdalia, Zaphrentis,* and *Cyathophyllum.* There are altogether in the British area one hundred and forty-four species of Carboniferous limestone corals, not one of which reappears in the next overlying formation, nor in any other.

Jurassic Reefs.

Our next stopping-place will be on the yellow Bath building-stone, extending from Whitby to Weymouth. The geological formation is called the Oolite (its grains being similar in shape to small eggs or roe), or the Jurassic, from its prevalence in the Jura Mountains. It is a series of sandbanks, now converted into freestone; mud, now turned into shale; and limestone, due principally to shells, and sometimes corals. In many places along the line it is evident that these former sandbanks were anciently crowned with coral formations.

These are so prevalent in one entire series that the rock is named the Corallian.

Mr. Etheridge enumerates not less than two hundred and thirty-six species of coral which have left their marks in the Jurassic rocks of England.

Cretaceous Corals.

We will very briefly refer to these. In the English chalk there are several small corals, mostly of single growth. In the sandy commons between the Great Western line and the town of Faringdon, in Berkshire, there are very numerous small excavations, which disclose beds of exquisite sponges and Polyzoa, but no corals. On the summit of Haldon, in South Devon, are remains of a small coral-reef in the Lower Greensand.

There are seventy-six species of corals enumerated from the Cretaceous strata, not reef-builders.

Tertiary Corals.

Still higher up, or more recent, in the early part of the Tertiary period, vast coral-reefs are found, of which the remains are now visible in Central and Southern Europe, in Egypt, Syria, Arabia, and parts of India. In our own island we find in the Suffolk Crag numerous beautiful Polyzoa, some sponges, and but very few corals, and those only of the single kinds.

Now, having given a cursory sketch of the dwelling-places, we must glance at the dwellers.

The coral-animal may be described as a tiny sea-anemone, which secretes within itself a stony cell having upright partitions. The building rises up as it grows, and when the creature dies, the little cell and its ribs become visible. In one group of corals, called tabulate corals, there are horizontal plates as well as vertical; in the other there are vertical plates only. The latter group is called Rugose, or wrinkled corals. The little Polyps (as the animals are called), are of several kinds; many have a tendency to live together in colonies. In the live coral we find only a small bag of animated substance open at the top, but more or less closed at the lower end. The inside of this bag has the power or property, by vital chemistry, of extricating and fixing grains of carbonate of lime from sea-water.

The reef-corals comprise:—

1. All the Star-corals (*Astræidæ*).
2. All the Mushroom-corals (*Fungaciæ*).
3. Certain of the Eye-corals (*Oculinidæ*).

4. Some of the Flower-corals (*Cyathophyllidæ*).
5. Madrepores, Brain-stones, and Free corals.

Among those genera which characterise successive rock-formations are the following :—

Lower Silurian	Zaphrentis. Heliolites, &c.
Upper Silurian	Halysites, Favosites. Monticulipora, Aulopora. Syringopora, &c.
Devonian	Cyathophyllum, Heliophyllum. Acervularia. Strombodes, Stromatopora. Favosites, &c.
Carboniferous	Lithostrotion, Lonsdalia. Cyathophyllum. Amplexus, Syringopora.
Jurrassic Coralline Oolite	Montlivaltia, Astræa, Isastræa. Theosmilia, Thamnastræa.
Cretaceous	Parasmelia, Syndelia, Stephanophyllia.
Eocene	Cup-corals.
Pliocene	Cup-corals.*

Lessons of the Reefs.

Have the corals anything to say on the subject of Evolution,—the great natural history question of the present day? Do they show by their structures that they were evolved from previous forms, that they changed with the ages in conformity with law, or must we say to those who thus express themselves,—

> "There are more things in heaven and earth, Horatio,
> Than are dreamt of in *your* philosophy"?

Regarding their succession, do we find the survival of the fittest, or proof of the change of one form into another by slow modification under the action of their surroundings? Surely they can tell us something about these matters; they have lived long, and passed through many revolutions, their features are fine enough to preserve traces of all the vicissitudes to which they have been subjected, and their forms are as definite as geometry itself. Our conviction is that

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* For full information see the works of the accomplished leaders in this department, Professor Duncan, Dr. Nicholson, and Mr. Tomes; and Mr. Etheridge's volume of *Phillips's Geology*.

among the enormous number of recent corals displayed in the British Museum of Natural History, and the number of fossil corals figured or described in the sumptuous publications of the Palæontographical Society*, there is no appearance whatever of any change or transformation from one species to another. The imaginary lines of descent, sometimes glibly laid down, so flattering and so fascinating to young philosophers, have no counterpart nor foundation in Nature.

The beautiful and often slender marks which divide the species from each other are more permanent and rigid than steel. To attempt to gloss over this absolute differentiation appears to me to be a task rather of the imagination than of science.

We have before noticed that coral-life burst upon the stage all at once; it continued in existence from that epoch until to-day.

The present reef-corals are classed by zoologists as all entirely different in species from the fossil corals; the fossil corals of each stratum differ, too, from those of others. We see at once that there has been frequent change, and it may be said progress in form, but not evolution. In order to be more fully persuaded of this, we will examine the subject more closely, for at a little distance the pyramid of life (which is arranged like some of the Egyptian pyramids in a gigantic staircase), looks like a smooth inclined plane, and it is not until we get near enough that we see the distinct steps. One of the leading differences is in the case of the Palæozoic corals, in which the vertical divisions are arranged in four plates and in multiples of four, whereas in the modern the plates are six, or multiples of six. This is constant, and not a mere variation, for there has been no recurrence to the old type.

The amplitude of the lists of Silurian species, and the great number of localities quoted, give pretty full evidence that the search for intermediate forms between existing fossils and some supposititious ancestor is a hopeless pursuit.

Nor can we find ancestors of the modern or of the Palæozoic corals in rocks still older than the latter; for, if we could throw back the creation of corals into the previous Laurentian age, and if we then found them in myriads, and traced them back even to the Eozoon, we should find no pedigree with any pretensions to minute verification or proof.

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* Edwards and Haimes' and Duncan's *Fossil Corals.*

The ancient *Cyathophyllidæ* were most important in size in Palæozoic times; but (with the exception of one doubtful form*) they have all become extinct. Yet, from their magnitude and perfection, if descent with variation were a good law, it seems inconceivable that a family so strong to the last should have completely died out, unless by virtue of some other law unknown to the naturalist.

The Carboniferous corals are also equally distinguished from the preceding Devonians by remarkable differences. The great majority of the Carboniferous genera are new.† We no longer encounter the feathery form of the *Favositidæ;* but we have a grand display of the almost universal *Lithostrotion*—a form which carries in its face the evidence of equality in size and beauty with any modern structures.

The great rough corals of the older formations cease altogether before the opening of the Jurassic coral-beds.

At first the Rugose corals bear the bell; next, the Tubulosa and Tubulata; and, during Oolitic days, the Aporosa and Perforata; and, after them, in the Cretaceous, the Perforata and Millepores.

It must be stated also that many species of reef-corals are liable to a considerable amount of variation; but these do not render classification difficult, nor occasion any confusion of species, nor necessitate new names. The degree of sunshine, the angle of growth, the condition of the water, all occasion variations; but, with all allowances which can be made, the evolution pedigree is radically defective,—it has too many blanks and loose statements to be seriously brought forward as evidence of heirship.

The reefs which we have been surveying proclaim that each platform of organic life, in regard to its antecedents, had a distinct separate beginning.

The late Dr. Wright, of Cheltenham, the shrewd and indefatigable explorer of life of the Jurassic period, and the skilled collector of the fossils of the Cotswold Hills, writes the following matured conclusions from the life-history of corals:—

"1. The genera and species of each of the great groups into which zoologists divide these animals have had a limited duration in time and space, no genera of the Palæozoic epoch having been found in any subsequent epoch, and no new living germs having been discovered in rocks older than those of the Jurassic period.

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* Dana, p. 57. † Nicholson, p. 175.

"2. There is no evidence of any gradual development having taken place in the class from a lower to a higher type of coraligenous structures. The old corals of the ancient reefs appear to have been as highly organised and as elaborately constructed as the modern corals now building reefs in our tropical seas.* The Cretaceous corals belong chiefly to families now existing, but there are still remaining here a very few instances of the old forms of tabulate corals, hardly distinguishable from Silurian species."

The life-history of fossil corals, therefore, so far as it can be gathered from the remains of their edifices, teaches us that there has been no transformation of those creatures by effluxion of time alone.

The facts prove the simultaneous introduction of whole platforms of organic life by some means unknown to science. There is a record which states this to have been effected by acts of direct creation. Science, with an admission of its helplessness, must bow before this. We must say with Goethe:—

> "None resembleth another, yet all their forms have a likeness.
> Therefore, a mystical law is by the chorus proclaimed.
> Yes; a sacred enigma."

Sir William Dawson, the accomplished President of the British Association in 1886, says:—"It is certain that, up to this time, the origination of the living being from the non-living is an inscrutable mystery. No one has witnessed this change, or has been able to effect it."

That Evolution is an unsupported theory is admitted by an eminent French scientist, who is, nevertheless, a favourer of the doctrine. Speaking of the coral-reefs, he says:—"The first corals, *Halysites* and others of the primitive genera, differ too widely from those which have succeeded them to allow us to consider them as their progenitors."† But he adds the gratuitous supposition that, alongside of the germs which we *do* find, lived others which we do *not*, which contained small modifications whereby the change took place,—a supposition unscientific and improbable to the last degree, considering the complete overhauling which the fossil-bearing beds have received.

Dr. Claus, the learned evolutionary physiologist, admits the insufficiency of this theory to account for the facts, and tries

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* *Proceedings of Cotswold Naturalists' Field Club*, p. 120.

† *Les Enchaînements du Monde Animal*, par Alfred Gaudry, p. 78.

to gain a victory, not by the prowess of his own troops, but by the alleged weakness of the other side.

He says :—

"However well grounded we admit the theory of selection to be, we cannot accept it as in itself sufficient to obtain the complicated and involved metamorphoses which have taken place in organisms in the course of immeasurable time. If the theory of repeated acts of creation be rejected, and the process of natural development be established in its place, there is still the first appearance of organisms to be accounted for, and especially the definite cause which the evolution of the complicated and more highly-developed organisms has taken to be explained."*

He further says :—"It must be admitted that we are entirely ignorant of the molecular basis of a living organism, and it exists under conditions the nature of which is, as yet, unexplained."†

This is not, however, a question to be settled by authority; and the fact that the authorities are, as we have seen, clearly conflicting, relegates us to the facts themselves.

So far as we can discover, difference of form is occasioned by difference of structure and arrangement in the soft parts, so that difference in species may be all traced to permanent difference in the tissues of the living animal.

These differences are manifested from the very first. The forms of the Spermatozoa, the very start of individual life, are distinctly different in each family. With more perfect vision and instruments we should doubtless find differences where we now only see similarities, and the vision of identity would vanish. It is the same if we trace the nucleus in the egg. The peculiar nature, the very essence and character of things is in and at their beginnings.

However development may be promoted by favourable surroundings, yet the act of the exercise of life is the act of the life itself. The faculty in the living coral (whatever it may be called) which determines the precise fashion which every molecule secreted from the sea-water shall assume, makes it to differ from any other form in the world above or below it. The influence of environment modifies individuals temporarily, but never transforms them. At least, we have no instance of any disposal by the creature into an absolutely new form.

The difficulties of evolution, in this case, seem to be very

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* *Claus*, vol. i. p. 179.

† *Claus' Elementary Book of Zoology*, vol. i. p. 9 (translated by Sedgwick).

great in view of the existence among the reef-corals of individuals associated together in a gelatinous mantle, penetrated by threads which are connected with the individual polyp, so that all contribute in common to the maintenance of the colony. The coral-animal being one of the radiate creatures in which there is symmetry between two or more segments, any differentiation in any part necessitates a twofold or fourfold change in the entire structure—a circumstance which renders specific change without renovation almost inconceivable.

Taking into consideration the facts referred to, and looking on a fragment of old Silurian *Halysites* (Chain-coral); and a superb lump of Devonian *Cyathophyllum;* a stone from a Carboniferous reef, *Lithostrotion;* and a mass of exquisite *Astræa* (Star-coral) from the Oolite,—we submit that there has been change without advance, and similarity apart from any parentage. The alterations were not made by any internal property, nor by any evolutionary process known to science.

Until further advised, I must be content to be ranked among the "scientific 'Rip Van Winkles,' who have been asleep for the last quarter of a century;" and, in spite of the eminent biologist and still more eminent writer in the February number of the *Nineteenth Century*,* express my belief in the existence of a vital force in living bodies behind and above all other activities.

Science alone is helpless and dumb before causation; we must either retire from the task in despair, or look up to God, and say with the Psalmist, "O Lord, how manifold are Thy works! in wisdom hast Thou made them all: the earth is full of Thy riches" (Psalm civ. 24).

The CHAIRMAN (Mr. H. Cadman Jones).—I am sure I may return the thanks of the Meeting to Mr. Pattison for his very interesting paper.

Captain F. PETRIE, F.G.S., (Hon. Sec.).—Two communications have been received. The first is from the President:—

"Lensfield Cottage, Cambridge,
"4th April, 1887.

"I think the case against evolution has been overstated. The limits of species are very uncertain; and it is constantly a matter on which naturalists have differences of opinion whether so and so are to be regarded as distinct species or only varieties. The only logical ground we

* Page 203, February, 1887.

have to go upon in declining to regard two forms as belonging to the same species, is the absence of reasonable evidence of transition. But our knowledge about this is very imperfect; and thus our ignorance tends always to the multiplication of species. We have abundant ground for refusing assent to the notion of transmutation when we take remote forms, and I do not think it is desirable to insist on the distinct origination of each of what naturalists regard as distinct species.

The second is from Mr. Hastings C. Dent, C.E., F.L.S.

"Dublin.

"I have seldom perused a paper read before the Victoria Institute which has given me greater pleasure. It is very convincing as to successive creations of groups and Persistence of Type.

"Owing to my not having studied corals specially, and so being unable to grasp, in the generic and specific names, the predominance of certain families of corals in the earliest and latest times, I should be very glad if Mr. Pattison would tell me whether there is, as it appears from the paper, a similarity in this group of Actinozoa to that of the Crustaceans, which I described in the latter part of a paper on 'Evolution and Degeneration, the Crustacea and Man,' a copy of which I sent to the library of the Victoria Institute some five years ago. In the Crustaceans the original important families of Trilobites and Eurypterids, which became extinct, are now represented in importance (commercially at least), by the Malacostraca, which are of a comparatively recent origin; and I gather from the paper that a similar predominance exists at the present time of a comparatively lower type, or later group, of corals from the original form. If this be so, the fact is of great importance to those who are contending against evolution.

"The Persistence of Type is, I think, the point to be adhered to especially, and it may be well summarised in those sentences on page 201.

"'We have before noticed that coral-life burst upon the stage all at once; it continued in existence from that epoch until to-day. . . . .

"'We see at once that there has been frequent change, and it may be said progress in form, but not evolution.'

"Species *per se*, are rather misleading; as now-a-days, especially, certain existing forms are designated by one naturalist as a species, by another as the variety of a species; some scientists apparently considering that the appearance of approximately the same form at widely separated portions of the globe, must necessitate its being a separate species. But in dealing with genera we have less difficulty, less fear of our position being assailed.

"Monsieur De Quatrefages remarks*—'Races and isolated varieties of a very variable species are taken for species so long as such specimens only are known; they are brought back to their specific type when one has been able to collect the intermediate forms which unite them. But to state the frequency of a fact which was thought rare or exceptional, is not to explain it' (p. 188).

"I have been much exercised, *e.g.*, in the specific determination of existing Lepidoptera, not only by the diverging opinions of English and German entomologists; but even by those of English specialists.

"When entering upon the origin of species, and derivation of genera, we must bear in mind that the theories of Buffon, Lamarck, St. Hilaire, Darwin, &c., on derivation, presented themselves to those scientists as probable, from the most careful consideration of the facts of varieties and new species

* Charles Darwin. . . . "Étude sur le Transformisme." Paris, 1871, p. 181.

appearing of which the transitions were palpable. The error was in arguing from the particular to the general; that is, in saying that if L produces M, then A must have been the ancestor of L, which is absurd.

"Mr. Pattison scores a strong point in his extract from Dr. Wright's paper (p. 203).

"'There is no evidence of any gradual development having taken place in the class from alower to a higher type of coraligenous structures. The old corals of the ancient reefs appear to have been as highly organised and as elaborately constructed as the modern corals now building reefs in our tropical seas.'

"I think it is quite sufficient for the author's purpose to have proved that in existing genera there is no proof of evolution in corals, and that the most ancient are as elaborate in organisation and construction as are those that at present exist; while it is also important to note that while elaborated in number of genera and species, there are yet remnants in later days, of old generic forms, thus proving Persistence of Type; and from finding no instances of the metamorphosis or transmutation of corals into other Actinozoa we may take our standpoint on—at least—the lowest grounds, in asserting that the intricate systems of organic beings move in collateral spirals, either ascending (numerically), practically stationary, or descending and degrading; and that though there are degraded and low forms in many orders which nearly approximate similar forms in other orders, yet there is no proof—but rather the contrary—that the lowest forms of closely connected orders had originally some yet lower common ancestor from which both sprang.

"Let us adhere to the grand, yet simple words of that much-maligned Gen. i. 'Whose seed was in itself, after his kind,' and we shall not err. These words are truly elastic, yet most dogmatic and definite.

"I wish the author had given us his theories as to the cause of the tropical heat in these latitudes which allowed for the gigantic coral beds in England, that cover so large an area, and form such an important part of the deposits in these localities in those bygone ages. I believe a minimum heat of water of not less than 66° Fahr. is necessary for the existence of corals."

Mr. R. J. Hammond.—The description Mr. Pattison has given of those old coral reefs is so charming that it will long remain on the retina of my mind; but, although this is the case, I cannot help thinking there are certain loose expressions in the paper which it would be well to have put in a more definite form. On page 200 of the paper we have the Syringopora mentioned in connexion with the Upper Silurian series, but the author goes right through the Devonian rocks without alluding to that order, and then, coming to the Carboniferous strata, we get to the Syringopora again. Of course, Mr. Pattison does not consider there have been two distinct creations of the same creature. Doubtless, he would say the creation is to be dated to the Upper Silurian, and that the order existed through the Devonian, although it is not mentioned in connexion with that series. In fact, it must have lived through that epoch because we come upon it again in the Carboniferous series. I would put it to Mr. Pattison whether, as this particular order is not mentioned in the Devonian period, other creatures may not have been passed over in a similar manner? Then, again, on page 202 he quotes Dr. Wright, the author saying, "No genera of the Palæozoic epoch have been found in

any subsequent epoch;" but to my mind that statement seems to be almost contradicted by what Dr. Wright says afterwards:—"The cretaceous corals belong chiefly to families now existing, but there are still remaining here a few instances of the old forms of tabulate corals, hardly distinguishable from Silurian species." Of course, to the scientific mind there may be some mode by which these two statements can be reconciled; but to me they certainly appear to have a contradictory tendency. It seems almost an invidious task to notice weak points in this beautiful paper, but there is another statement which I think open to observation. On the top of page 202 there is the expression, in brackets, "But, with the exception of one doubtful form,"—now an evolutionist might say, "There is an important exception in the case of this 'one doubtful form.'" It may be that that exception is a very powerful one. I should here like to ask one question with regard to these separate creations. Does he think that in the case of these separate creations there have been creations of vast numbers, or does he suppose that only a small number of these coral insects were created at first, and that their increase was due to the ordinary process of generation?

Mr. W. GRIFFITH.—I think our friend who has just spoken rather misapprehended the argument of the lecturer, which, as far as I understood it, was that there was no instance of development in these different corals. The fact that we have the same coral in the Devonian and in the Carboniferous strata does not by any means prove that the one was developed from the other. On page 202 of the paper it is stated that "the ancient Cyathophyllidæ were most important in size in Palæozoic times; but, with the exception of one doubtful form, they have all become extinct." That statement may imply that one of those forms may or may not be in existence; it does not say that the doubtful form may have been developed from a previously existing form. *The subject is necessarily difficult, owing to the somewhat ambiguous sense in which the term evolution may be employed.* The greatest writers on each side often use the word in an ambiguous way. We must admit that there is evolution, at least to some extent. When we have an artificial arrangement of species we naturally make mistakes and put forms into one species which ought to be put into another. It is not necessarily proved that one form was necessarily evolved from the other, but rather that we make mistakes in our classification. We ought to be more exact in our specification and marking out of species and genera; otherwise we shall make mistakes. On the other hand, if we admit all that is stated on behalf of evolution, we do not necessarily deny the Creator. Certain successive forces may have been attached to natural bodies and these may have produced a kind of evolution, and yet, unless those forces sprang into existence of themselves, they do not therefore deny creation. Those forces must have been caused in some way by external action, and, although they produce certain effects, they are altogether independent of those effects. I think the weakest part of the evolution theory is that it only takes a survey of part of the great field of creation; and in saying "creation" I do not wish to prejudice or anticipate the

argument; I will, therefore, say, the great field of nature. The evolutionists may show that certain species have been evolved from others, but they have never been able to prove that life has evolved itself. They have never been able to show that the moral qualities have been evolved from a lower state of existence, or that the intellect of mankind and the higher spiritual forms of life have been evolved. The great fault committed in this controversy is that we sometimes take different views of the meanings of words, such as the word "evolution," and that we do not take a sufficiently extensive view of the facts from which we make our inductions. The real question at issue is whether at any particular time there has been an act of creation; because, if there were an act of creation, certain qualities may have been attached to the thing created which may have evolved subsequent consequences. There was a paper published some time ago in the *Nineteenth Century*, in which Mr. Gladstone discussed this question, and Professor Huxley replied. Mr. Gladstone wisely took a somewhat legal view of the question and and reduced the controversy to this point: "Is the first chapter of Genesis credible or is it not?" On this point I should be happy to put myself under the guidance of Mr. Gladstone rather than of those who, like Professor Huxley, take what I would venture to call a limited view of the question, and do not establish any conclusion. Learned natural philosophers may show evolution in a particular place, but, unless they show that everything has been evolved, they do not establish the conclusion that there has been no creation. The Creator may have willed that there should be evolution in a particular place, and, if that be so, it militates against the correctness of Professor Huxley's conclusion. Undoubtedly, if this question had to be decided by an intelligent jury who had to deliver a verdict, "ay" or "no," they must say that the case for evolution has not been proven. No doubt, when you have a controverted question before a jury, you have to look at all the facts and to frame a theory which explains the facts; and unless that theory explains all the facts, the verdict will be against the theory, and will be given on the other side. Certain explanations all evolutionists do give; but, although they explain some, they do not explain all the facts belonging to the natural philosophy around us. They do not show how inorganic nature has become endued with life or has been changed into organic nature, or how the lower animal life has become endowed with moral qualities, or how intellect or the higher forms of spiritual life is produced from the lower forms of animal life.

The AUTHOR.—The last speaker has furnished a complete reply, such as I should otherwise have attempted to have given to Mr. Hammond. He has explained the fact which the first speaker was quite right in calling attention to, namely, that in the three instances in which I spoke of the continuity of things I have spoken of species and not of genera. The cases that have been referred to are those of the continuance and the recurrence of species; and it is quite true that there has been no recurrence of species though there has been a recurrence of genera. I ought to have put that a little more plainly. I should have shown more clearly that species do not

recur, but that genera do. I think that nothing could be better than the simple way in which Professor Stokes has left the question. There is an absolute absence of all evidence of transition, which, I think, is proved by the facts I have brought before you. That there can be no evolution in the forms which are brought before us; that there may not be evolution in some shape or other with which we are not acquainted I should be very loth to deny. I cannot, however, dogmatise on a matter I know not. All I say is that the facts I have given prove, as they present themselves to me, that there is no evolution in the common sense—namely, that these things create themselves, or by themselves originate a different order of succession. In reply to the question whether these numerous species were made all at once, or whether they came into being gradually by parentage, I should give the answer that both are true causes. I cannot look at those old Silurian rocks without seeing that a great number of species have come to us which have been created all at once, because we find them in the same layer. It is true that there is great difficulty in conceiving the way in which creation could have been effected, and that difficulty it is not at present given to us to solve. It may be some day, and certainly in eternity, if not in time. I am only dealing with facts as they are, and cannot pretend to give the rationale of God's dealings with nature where He has not revealed them. I am not aware that there is anything more about which I need trouble you. It is quite true, as Professor Stokes indicated, that my statements are a little too absolute with regard to the occurrence of the division plates as being six in the modern and four in the ancient corals; that is to say, there has been found one species in which it is doubtful whether this is true or not, but this is so minute a matter that it does not affect the general question. I did not mean to treat on corals at large, but only to give the conclusions I have formed on a mass of evidence with reference to the points I have dealt with. I am much indebted to Mr. Lea for his valuable letter, to those gentlemen who have spoken, and to all present for the kind way in which my paper has been received.

The Meeting was then adjourned.