
A table of contents for *Journal of the Transactions of the Victoria Institute* can be found here:

https://biblicalstudies.org.uk/articles_jtvi-01.php

JOURNAL OF

THE TRANSACTIONS

OF

The Victoria Institute,

OR

Philosophical Society of Great Britain.

EDITED BY THE HONORARY SECRETARY,

CAPT. FRANCIS W. H. PETRIE, F.R.S.L., &c.

VOL. XVIII.

LONDON:

(Published by the Institute)

INDIA: W. THACKER & Co. UNITED STATES: G. P. PUTNAM'S SONS, *N.Y*

AUSTRALIA AND NEW ZEALAND: G. ROBERTSON & Co., LIM.

CANADA: WILLARD Co., LIM., *Toronto.*

S. AFRICA: JUTA & Co., *Cape Town.*

PARIS: GALIGNANI.

1885.

ORDINARY MEETING, April 21, 1884.

H. Cadman Jones, Esq., M.A., in the Chair.

The Minutes of the last Meeting were read and confirmed, and the following Elections were announced :—

Members :—T. C. Edwards, Esq., Yorkshire; C. J. Lacy, Esq., London.

Also the presentation of the following work for the Library :—
"The Isle of Wight." By Captain J. Brown. *From the Same.*

The following paper was then read by the Author :—

THE EVOLUTION OF THE PEARLY NAUTILUS.

By S. R. Pattison, F.G.S.

IT is a bold, perhaps a rash thing, to question a biological conclusion publicly expressed by the present distinguished President of the Royal Society. But no one would be more ready than he to encourage the pursuit of truth, and in the interest of the latter I offer the following remarks on the subject of evolution, in opposition to statements and inductions expressed by Professor Huxley in the Rede Lecture delivered at Cambridge in the month of June last, and reported in *Nature* of June 21, 1883.

The President defines the term evolution to mean "that the different forms of animal life had not arisen independently of each other in the great sweep of past time, but that the one had proceeded from the other; and that that which had happened in the course of past ages had been analogous to that which takes place daily and hourly in the case of the individual; that is to say, that just as at the present day, in the course of individual development, the lower and simple forms, in virtue of the properties which were inherent in them, passed step by step by the establishment of small successive differences into the higher and more complicated forms, so in the case of past ages, that which constituted the stock of the whole ancestry had advanced grade by grade, in steps by steps, until it had attained the degree of complexity which we see at the present day."*

This clear statement of the proposition amounts to an assertion that all the differences between life-forms, ancient and modern, have arisen from time to time by virtue of "inherent properties."

The eloquent lecturer then sets himself to prove that this hypothesis coincides with the actual life-history on the globe. The evidence on which he relies is, that of the animal inhabiting the shell of the pearly nautilus, as compared with the indications presented by fossil shells of the same general kind. He selects from among the ancient fossils, one called an orthoceratite, a perfectly straight form; he takes this and claims for it the distinction of having been the father and founder of the whole nautiloid tribe. He says that it first underwent a slight curvature and became the cyrtoceras; in course of time the curving and rolling up of successive individuals became gradually more and more complete, until it finally issued in the beautiful *Nautilus Pompilius* of the present seas. That the proposition may be more fully before you, I quote further from the report:—"Unquestionably, nautili were found as far back as the Upper Silurian age. Before that time there were no nautili, but there were shells of the orthoceratidæ—of which there were magnificent examples before him—which resembled those of the nautili in that they were chambered, siphoned, &c., with the last chamber of such a size that it obviously sheltered the body of the animal. He thought no one could doubt that the creatures which fabricated these still earlier shells were substantially similar to the nautili, although their shells were straight, just as a nautilus shell would be if it were pulled out from a helix into a cone. Then came the forms known as cyrtoceras, which were slightly curved. Along with these they had the other forms which were on the table, and in which the shell began to grow spiral. The next that came were forms of nautilus, which differed from the nautilus of to-day in that the septa were like watch-glasses, and that the whorls did not overlap one another. In the next series, belonging to the later palæozoic strata, the shell was closely coiled and the septa began to be a little wavy, and the whorls began to overlap one another. And this process was continued in later forms, down to that of the present day. Looking broadly at the main changes which the nautilus stock underwent, changes parallel with those which were followed by the

---

* Rede Lecture, *Nature*, June 21, 1883, p. 189.

individual nautilus in the course of its development, he considered that there could be no doubt that they were justified in the hypothesis that the causes at work were the same in both cases, and that the inherent faculty, or power, or whatever else it might be called, which determined the successive changes of the nautilus after it had been hatched, had been operative throughout the whole continuous series of existence of the genus from its earliest appearances in the later Silurian rock up to the present day."

This was his case for evolution, which he rested wholly upon arguments of the kind he had adduced.

Will it surprise you to be told, after this, that not only is the argument hypothetical, but the facts are hypothetical too? for in the British rocks, and presumably elsewhere, the orthoceras never turned into a cyrtoceras, for the simple and sufficient reason, that the latter actually preceded the former.

They both appear in the same geological day, the epoch of the upper Cambrian, but the cyrtoceras is the first in the field.* After their first appearances both subsist, fully formed and equipped for the campaign of life, both preserving their respective identities, quite distinct from each other, both subsequently become scarce, and disappear. Whilst they lived together side by side in the Silurian times, new genera and species were added to each until there came to be no less than 143 distinct creatures, going down from age to age in lineal descent belonging to the orthoceras group, and 369 belonging to the cyrtoceras, enjoying the same surroundings in every respect, but each species keeping to its own model.

Professor Huxley accounts for the multiplication and variety of these creatures by the hypothesis that the cyrtoceras is an orthoceras in the first instance curved by accident or by external conditions, that thenceforward this individual produced progeny similarly curved, and then similar causes produced like occurrences in succession until the thousand varieties of cephalopodous life thus arose, and what occurred in one group happened also in all, and hence the variety displayed throughout the animal kingdom. Now, whatever else may have been the true history of the origin of the great

---

* Salter's appendix: *Memoirs of Geol. Survey*, vol. iii., p. 358. "It is the earliest of the Cephalopods known, and it is not a little remarkable that the first species we meet with in ascending order should be—not orthoceras, which is the most diffused and persistent form, but a genus which, so far as we know, is only Silurian and Devonian."

decayed cephalopodous family, I hope to show you that this is not its true pedigree, that the straight orthoceras is not the root of title.

But the President has a right to say that he needed not to ground his argument on the evidence of British rocks alone, nor place it on so narrow a basis as the mere form of the shell. This must be granted. Subsequently to the delivery of his lecture, a most potent ally has come forward in the person of my friend Professor Alpheus Hyatt, the Curator of the Natural History Society of Boston, in Massachusetts, who has devoted all the powers of an acute intellect, large experience, and ample opportunity on both sides of the sea, to the investigation of this very subject, and who has just published, in the proceedings of the Boston Society, his adoption of evolutionary views and of the theory of Professor Huxley. Notwithstanding this, I will try to lay before you the reasons which, in my judgment, are decisive against the conclusions of these eminent men. In doing this, I shall have to trouble you with some dry details of geological, or rather palæontological facts regarding the succession of rocks, and of the life indicated by their fossil contents.

We have first to speak of the shells.

The nautilus is, as is well known, the sole living representative of a vast family of marine creatures, which flourished in the first palæontological ages, and are known to us in a fossil condition under various names. In the lowest strata the form called orthoceras prevailed, though, as we have shown, it does not appear first. In subsequent times the coiled ammonite is the prevailing form. The latter is so numerous in the rocks that its remains stand as the popular type of fossil life in general.

These creatures belong to the group of cephalopods, the highest form of animal life existing in marine shells. They derive their distinctive class-name from their having the feet placed in a ring round the mouth.

The commonest cephalopod now known to us is the cuttle-fish, which has an internal calcareous support; the most beautiful, externally, is the pearly nautilus before referred to. The nautilus has two pairs of gills, the cuttle-fish only one pair, and the whole assemblage is divided into two families possessing this difference,—the one called the dibranchiates, the other the tetrabranchiates. The former, the cuttle-fish kind, are the most numerous in the present seas; but in the ancient oceans the nautiloids prevailed, and formed really the leading feature in the life of the period, so far as we know. The London clay immediately beneath where we now stand contains the shells of numerous species of true nautili, and so does the chalk beneath, whilst that, and the oolites lying next below, abound also in ammonite forms, and the still underlying rocks are thickly strewn with other members of the great tribe.

For the present investigation it is only necessary to dwell principally on two leading forms,—the old straight fossil orthoceras, and its companion called the cyrtoceras, differing from the former in being slightly curved.

The chief home of the orthoceras and cyrtoceras is in the Silurian, both are also found in the Devonian. They begin to be supplanted by other genera in the carboniferous limestone, abound in profusion, in the guise of ammonites, in the Jurassic; rapidly decline and become feeble in the tertiaries; and, save as to the nautilus, are extinct in the present world.

The shell of the orthoceras appears to have resembled that of the pearly nautilus in that it was divided by shelly partitions (called septa) into numerous chambers, connected only by a tube called the siphuncle, running through the septa, and terminating in the body of the animal. The latter evidently lived in the last and largest chamber, the other chambers acting as floats, the siphuncle keeping the chambers in a living condition. The shell of the present nautilus is always completely and elegantly curved, whereas that of the orthoceras is always straight. There are other differences, but the argument of the Rede Lecture is founded on this one distinction. It assumes that the straight form became casually curved in some one individual, whence sprang other similarly curved creatures now named cyrtoceras. A multitude of such casual variations, becoming fixed from generation to generation, constituted the cyrtoceras tribe, whilst some other casual adventure or adaptive habit produced further coiling up and corresponding changes, which resulted in the populous races of ammonites and the persistent nautilus.

We may incidentally remark that both shells, thus claimed as parent and child, have ornaments in the shape of furrows and lines, probably with colour (of which some traces have been seen), thus displaying similar regularity and beauty to the features possessed by their modern representatives. It serves still further to connect the present with the remote past, to learn that the shells of these fossil orthoceratidæ afford, in some instances, marks of having been broken during life, and repaired again by the animal. The very dawn of life on the earth is chequered by ruin and restoration. The cephalopods were the monarchs of the sea, and, indeed, of creation, for there are no remains of fishes, and we have no trace, in the earliest formations of any land animal. There are orthoceratites upwards of 10 feet long. Their function appears to have been to keep the seas clear of superfluous animal matter. No one who has looked a cuttle-fish in the face would wish to cope with an enlarged addition of the uncanny creature, however beautiful its shell might be.

Having now described what we are to look for in past life, I must briefly refer a little more fully to the places where we are to make our search.

The lowest group of sedimentary rocks is called the Laurentian, largely developed in Canada, where it was first distinguished and named. This is estimated at 30,000 feet thick, and consists of gneiss, quartz-rock, and limestone, with occasional beds of graphite. The old granitic rocks of the West of Scotland, and the hard, dark rocks of Skye, are supposed to belong to this series. No trace of organic life has been seen in any part of this vast formation, with the single exception of the masses of eozoon, a foraminifer developed and elucidated by the happy labours of Dr. Dawson, of Montreal. Next to the Laurentian, lying upon it, comes a series of coarse, hard rocks, called the Huronian, in which no fossils have yet been found. The reason for placing the Huronian over the Laurentian is that the former lies unconformably on the upturned edges of the latter. Next in the ascending scale is the series in which our best slates are found in Wales, and hence called the Cambrian. These show, in some of their layers, very numerous remains of small marine animals, including a bivalve mollusc called Lingula. The Lingula zone is the equivalent of the Potsdam sandstone of North America, and of the primordial zone in Bohemia. The Skiddaw slates in Cumberland, and the Quebec group and calciferous slates of New York county are also on this horizon. The assemblage of organic life shown by these rocks displays the well-known curious crustaceans as called trilobites, with great numbers of graptolites, and some shells and sea-urchins but no cephalopods. Next in our upward course occurs a series of slaty rocks, named, from the place where they were first distinguished, the Tremadoc slates. These are on the upper Cambrian level, and contain a distinct collection of animated life, still marine only, and numbering, for the first time, cephalopods. Amongst these latter the bent form, cyrtoceras, occurs in the lowest beds, and the straight form, the orthoceras, over them, as may be seen, at Tremadoc, in North Wales.

Dr. Blake, the chronicler of the British cephalopods, writes:—"The first to appear is cyrtoceras, represented by *C. præcox*, though followed in the uppermost division of the same rocks by *Orthoceras sericæum*. It has been thought remarkable that the less simple forms should precede the straight orthoceras; but the history of discovery shows that we can place but little trust in such an isolated fact as it is liable any day to be reversed."* Although, therefore, we might be able to claim for the cyrtoceras the distinction of being the primal cephalopod, and so show the impossibility of its having, as the President thought, descended from orthoceras, yet we decline to snap a verdict in this manner, lest it should be reversed on a new trial by the production of further evidence. We prefer to open the question and look at all possible evidence in support of the Professor's proposition.

Those who have to plead for evolution from the orthoceras do not affirm that this was the first creature of its kind, but the first creature of present kinds. They assume the existence of some earlier stage of life (of which, how*ever*, we have no evidence what*ever*), in which there existed earlier and simpler creatures whence either cyrtoceras or orthoceras proceeded, or both. Palæontologists know nothing of this. Mr. Hyatt admits that "in all the larger series of shell-bearing cephalopods the nautiloid shells belong to several distinct series," which, he states, "arose independently from straight cones through the intermediate graded series of arcuate and gyroceran or clearly coiled forms." He lays it down that the ammonites are evidently descendants of the nautilinidæ, and that the evidence is strong that the whole order arose from a single organic centre, the nautilus of the Silurian, or the orthoceras of the Cambrian. But how is this statement consistent with the conclusion of the same writer,† that the study of the tetrabranchs teaches us that, "when we first meet with reliable records of their existence, they are already a highly organised and very varied type, with many genera." They must have had ancestors now unknown to us, "but at present the search for the ancestral form is, nevertheless, not hopeful."

When you visit the grand, capacious Natural History Museum at South Kensington, you find, in the department devoted to molluscan fossil remains, one room,—the first,—appropriated to cephalopods. The first cases on the right, as you enter, contain the orthoceratites, and next to these are the cyrtoceratites. This relative position is not indicative of order in time, but of apparent simplicity of form. The distinction between the two forms is immediately perceived. The cephalopod room is well worthy of study in the light of the early appearance of these creatures on the earth, and their apparently

---

* Blake, *British Cephalopoda*, p. 238. † *Science*, Feb. 1, p. 127.

sudden and general diffusion. Mr. Hyatt, in his work of careful analysis, describes and names 137 genera of the tetrabranchiates, all well marked by permanent transmissible and transmitted differences. The greater number of these arose during the very early period of the life of the globe. It is, of course, conceivable that all these were the results of a natural law, seated in the first and simplest specimen; nor, of course, would this conclusion be at variance with the strictest theism. We might believe that the curved form issued from the straight, and the coiled-up creatures with fringed partitions grew out of the simple ones with even septa; and, again, that the forms uncoiled and ultimately again became straight as in the bactrites of the chalk. But we have no instance whatever, in the whole field of nature elsewhere, of any such series of changes. Time works wonders, it is said, but does not work wonders *per se*.

On further inquiry into the relative numbers of the two forms, taking the "painful" labours of good Dr. Bigsby as our guide, we learn that there are in the Silurian rocks 317 species of the extinct cyrtoceras, and 143 of orthoceras. In the succeeding formation, the carboniferous, there are registered 24 of cyrtoceras and 114 of orthoceras.*

We have thus the contemporaneous existence, through untold ages, of these two typical forms of life, remarkably alike, yet also actually different; each species resembling the other accurately, in all but the minute characters which separated them; each genus and species pursuing its own way without change from age to age in the presence of countless individuals of other genera and species living under precisely similar conditions, yet the two families, the orthoceras and cyrtoceras, ever remain distinct; no more changed by their environments than Egyptian mummies in their grim companionship, each enfolded in its own multitudinous wrappings. As Professor Hall, of Albany (who has probably seen more of these fossils than any one else), said to me last summer, "An orthoceras was always an orthoceras and nothing else, and a cyrtoceras was always a cyrtoceras and nothing else."

I wish, therefore, to maintain that the one is not a variation from the other, but a distinct thing, so far as we have actual evidence; indeed, modern geology is largely based on the permanent or constant distinctions existing between organic fossils.

Prolonged experience has only strengthened the conclusion drawn by William Smith, the father of English geology,

---

* Bigsby's *Thesaurus: Siluricus*, 1860; *Devonico-carboniferous*, 1878.

nearly a century since, that strata may be identified by organic remains. Most of the species of the latter prevalent in one formation are peculiar to it, whilst some survive through two or more of the successive stages of the solid deposits of the earth; new forms come in at every stage; and, until some competent second cause can be established accounting for these new appearances, we must perforce call them creations. The similarity of the new forms to the old, and the harmony of the whole, oblige us to term it creation by law,—a law very similar to evolution, for the forms succeed each other with differences so slight, that, but for the permanency of the effects, they might be frequently assigned to casual variation. But the results appear to show that every step requires and displays some fresh adjustment, the exercise of a mind *ab extra*. What differences in organic life may be classed as mere modifications, and what may be deemed new departures, must be the subject of protracted observation, and perhaps of dispute, but the distinction is not the less real for this. The researches of Mr. Darwin, though not successful in piercing the mystery of the *modus operandi*, have yet taught us much concerning the limits of variability. They certainly have not established the fact of unlimited variability, which would be requisite for the maintenance of the theory of evolution.

Reverting to the main scope of the present argument, I have to state that, so far as we know, the cyrtoceras and the orthoceras were the first creatures of their class. Previously to their appearance, the rocks show the presence of molluscs of entirely different and lower type. It is not pretended that amongst the latter any ancestor of the cephalopods can be detected. It is certain, says the accomplished Monsieur Gaudry, that the extinct kinds had no influence whatever in the formation of their successors. In palæontology evolution subsists only as a mental conception; as we have seen, the two leading forms which are selected by the Rede lecturer, were present at the earliest life-period of which we have any trace of anything at all like them.

Of course, the differences in the form of the shell are simply indicative of differences in the contained animal. We have no difficulty in concluding that a constant transmissible difference in the form or curvature of the shell is the result of a similarly constant difference in the living animal.

One internal difference between cyrtoceras and orthoceras is in the usual position of the siphuncle, the tube which runs from the body of the animal backward through the chambers. In orthoceras, though not absolutely invariable, yet it is very nearly so, so much so as to be considered characteristic, whereas in cyrtoceras the siphuncle is placed sometimes on the dorsal, sometimes in the ventral margin, "and in every conceivable position between these two points." *

Both the orthoceras and the cyrtoceras are nautoloids, and commence life alike in one respect, namely, with conical nuclei or ovisacs, as distinguished from the rounded ovisacs of the subsequent ammonites.

Professor Huxley would have us infer that the ammonite is a modified orthoceratite, but the present state of our knowledge does not confirm this. Monsieur Gaudry, one of the great masters in this science, when writing on the ovisacs, lays it down as follows :—" We must admit that this difference, shown so plainly in the upper Silurian epoch, is, in the present state of our knowledge, an argument of weight against the idea of linking together the whole creation." † Since the researches of Professor Hyatt this characteristic has lost some of its value; but, although he traced in one or more genera the existence of an ammonitoid nucleus, yet, in the vast majority of instances, the old radical difference obtains. As Dr. Blake says :—" We may here learn those characters which point to the origin of the forms possessing them, and any fundamental distinction found will prove a bifurcation of the group." ‡ The little cap, or ovisac, is by Sir Richard Owen called the protoconch, and is a distinguishing mark of origin in the vast majority of cases.

Mr. Hyatt lays much stress on the embryological facts which he considers that he has established, that every individual curved cephalopod began life as a straight embryo, becomes curved in its growth, completes its curvature at maturity, and has a tendency to uncoil as it arrives at old age. He finds in this life of the single creature a representation of the life of the tribe, and argues that in both cases alike the growth is purely natural, and, as it were, self-contained. Surely this is analogy and not natural history. The tribal and the individual life may thus be parallel in part only. He himself says elsewhere :—" We cannot say that the causes which produced old age, and those which in time produced retrogressive types, were identical." §

It seems obvious, therefore, that no reliance whatever can be placed on the argument from embryology.

It is admitted that the marvellously rapid introduction of new species of these two orders in the Silurian epoch is

* Salter, *Memoir by Ramsay, North Wales*, vol. iii., p. 374.
† Gaudry, *Les Enchainements du Monde, &c.*, p. 173.
‡ *Fossil Cephalopoda*, p. 24. § *Science*, February 8, p. 149.

contrary to all our experience of rate of change at present: two assumptions have to be made to get rid of this difficulty; first, the usual one of inconceivably long periods of time; and, secondly, the supposition that the changes took place with far greater rapidity then than now, of which, however, there is no proof whatever. On the contrary, the force of heredity is said to be always greatest nearest to the origin of the form. It is a somewhat singular circumstance, and not without a bearing on our question, that in the case of the ammonites we find the first forms closely coiled, but one of the principal last forms—the baculites—is absolutely as straight as the orthoceratite. If the process from the straight form to the curved is to be called evolution, by what name shall the reverse be distinguished? I show you a baculites, that you may see that it is not merely an uncoiled ammonite, any more than an orthoceratite is not merely an uncoiled nautilus,—but both are distinct forms, not degenerate but independent creatures.

The importance of the subject, as now elevated into a test case, must be my apology for adducing some authorities on both sides, in addition to those previously mentioned.

We may quote on the one side the utterances of Professor Flower at the recent Church Congress at Reading, who boldly says:—

"The opinion now almost, if not quite, universal among skilled and thoughtful naturalists of all countries, and whatever their beliefs on other subjects, is that the various forms of life which we see around us, and the existence of which we know from their fossil remains, are the product, not of independent creations, but of descent, with gradual modification from pre-existing forms."* He afterwards, however, states that direct proof of the theory is wanting.

On the other hand, Dr. Duncan, in his presidential address to the Geological Society in 1878, comments on the difficulties of evolution in reference to the nautiloids as follows:—"Every student of palæontology must be impressed at the commencement of his studies with the excessive variety of form displayed by the tetrabranchiate cephalopoda, and when informed that it is produced by natural selection wonder is felt that the shapes assumed had a curious resemblance during the same geological age over the whole world, and that the genus *Nautilus* should have remained so little altered in spite of the struggle for existence, the survival of the fittest, sexual selection, and adaptive modification." †

* *Nature*, October 11, 1883. † *Quarterly Journal, G. S.*, vol. xxxiv., p. 68.

To oppose my able friend Alpheus Hyatt, I would call up the old renowned chief from Bohemia. The Silurian rocks of that country were patiently examined during a lifetime by the high intelligence and industry of Joachim Barrande. They present most favourable conditions for the search; in no less than 665 species of cephalopods, crowded in a succession of strata generally similar in mineral composition, the phenomena of progressive life forms are abundantly displayed. Barrande writes that he was much struck with the *contemporaneous* appearance of orthoceras and cyrtoceras; and on the whole subject, as the result of his studies, he states that the facts positively forbid the conclusion that "the numerous and varied specific forms of each generic type are derived from each other by a slow and imperceptible transformation, under the influence of the surrounding medium."

Again he writes in his great work:—"In short, the differences between the zoological and chronological evolution of the cephalopods are so great and so plain that it is impossible to recognise any harmony between the two series; but both, being equally founded on facts and considerations outside all arbitrary influence, have their origin in the laws of nature.

In the face of these difficulties, theory can have recourse to the usual excuse, based on the lack of sufficient palæontological evidence. It can also call in either the unfailing resource of infinite and boundless ages of time before the beginning of the palæozoic era, or finally complete destruction of the organic remains in the metamorphic rocks."

Reverting again to a theory which would connect the cephalopods in the chain of evolution, he says:—"Although it is impossible to compare with accuracy the periods when the cephalopods made their first appearance in different countries, we may consider as the oldest representatives of this order those which appeared in Canada and England before the complete establishment of the second fauna. We must then be astonished at seeing that in these two countries the first forms belong to two different types. Thus in Canada there are found small orthoceratites in the passage-beds between the Potsdam sandstone and overlying series; in England, on the other hand, the first form is a little cyrtoceras of the Tremadoc fauna." *

And still further:—"In other words, the absence of the cephalopods in the primordial fauna cannot be reconciled with any hypothesis which would tend to carry over the origin and

* Page 155.

development of these molluscs to a pre-Silurian period. We are, therefore, obliged to give up this hypothesis in order to explain the simultaneous appearance of numerous specific or generic forms of this order at very distant spots on the surface of the globe about the time of the origin of the second fauna. . . . . . .

After the facts and considerations which have gone before, the disagreements shown between the zoological and chronological evolution could not be made to disappear, either before the excuse of the lack of sufficient palæontological evidence, or before the hypothesis of a series of anteprimordial faunas, or before the supposition of the total disappearance of the vestiges of these faunas through the effect of the metamorphism of the rocks. . . . . . .

These disagreements, then, remain in science to show us that the order of the cephalopods, that is, the first order among molluscs, by its organisation, as well as by its numbers, its variety, and the strength of its representatives during the Silurian ages, altogether eludes the ideal combinations which would tend to derive its origin and its primitive form from an imaginary individual, by an indefinite succession of imperceptible variations before the palæozoic era. This bears witness to the powerlessness of theories or self-made explanations to reveal to us the means by which it has pleased the Creator to introduce organic life upon the globe, and to provide for the succession and development of the types which should represent them, each one in the period which has been assigned to it by eternal wisdom."*

So far Barrande.

M. Gaudry, one of the ablest of living palæontologists, an evolutionist, concludes his statement of the case with the following important sentences:—"But, to be strictly correct, it must be added that, in the actual state of our knowledge, we are scarcely permitted to pierce the mystery which envelopes the primal development of the great classes of animal life. No one knows the manner in which the first creature of the foraminifera, the polyps, the jelly-fishes, the urchins, the brachiopods, the bivalves, the ostracods, the univalves, the trilobites, the decapods, the myriapods, the insects, the spiders, the fish, the reptiles, &c., appeared. The most ancient fossils have not yet furnished us with positive proof of the passage of animals from one class to another class." †

I sum up by claiming, on the issue of evolution by the

---

* *Syst. Silurien de la Bohème*, ii., p. 157. † Gaudry, p. 292.

influence of external circumstances or internal growth, a nonsuit, or a verdict of "not proven," as well on the evidence as on the admissions in the cause.

But testimony of all kinds appears to be readily set aside by the fascinating, flattering power of the doctrine of evolution. The proposition is repeated so loudly and continuously that it has begun to be accepted as an axiom, not to be questioned. It goes without argument. When a term becomes popular, it invariably comes to be used in a loose sense. Evolution, strictly, can only apply to action taking place in the subject; but, in a looser sense, it is now used to express the successive additions to the subject derived from any source. It is used to include all effects produced by a guiding principle or a possible accident. In order to account for the origin of a species, it is popularly held that nothing more is required than to show one very near to it, and thus resemblance is magnified into cause and effect. But surely permanent differences must indicate the action of corresponding constitutional powers. Naturalists find barriers, which they treat as boundary lines, only because they are so. They call the assemblage of facts within areas so bounded a species, and claim for it an independent origin, and call the mode in which this was brought about creation, for want of any adequate secondary cause. The common sense and common speech of mankind are on their side. Either cephalopods must have been derived from some simpler form, by minute stages of difference, or, they must have been originally created as we now find them; and if the latter supposition, which we have seen is an hypothesis surrounded with difficulties hitherto unsurmounted, requires the multiplication of miracles, we are not alarmed at this conclusion. Up to the present day the domain of natural history has been searched in vain for any second cause adequate to produce the permanent difference between races. Evolution may be a plausible guess, it may be a working hypothesis, but I do not think it bears examination; and there are those who properly say, Why should we resort to guess-work when another department of knowledge gives us the plain, simple truth,—God made "everything after its kind"?

Mr. Bouverie Pusey, recently here, successfully established the proposition that variation in the animal kingdom is limited and exceptional. The law which has ruled the existing differences must be a manifestation of creating, and not merely of unfolding. The direction of the will-force was evidently in such lines as to make the successive subjects as nearly alike as possible compatible with ordered essential differences. The divine skill with which this has been accomplished appears to be the source of our embarrassments. Permitted variations necessary for life under actual conditions render the problem still more puzzling, and give us ample room for experiment and observation to distinguish between constant and inconstant differences; but this need not drive us to despair, for we do not choose to contemplate nature apart from God. It has been well said by Canon Westcott, that "theology accepts, without the least reserve, the conclusions of science as such; it only rejects the claim of science to contain within itself every spring of knowledge and every domain of thought."* Nor are we justified in substituting imagination for reason. Let us, by all means, use analogy, fancy, and poetry for our enjoyment and delight, they are beautiful and profitable modes of thought; but, in constructing the Temple of Science, we may use them as embellishments, not as building materials.

The CHAIRMAN said he was sure that the hearty thanks of the meeting would be readily granted to Mr. Pattison for his most valuable and interesting paper.

Mr. S. R. PATTISON, F.G.S., said that the point he had endeavoured to bring forward was this: Professor Huxley had advanced the theory that the Pearly Nautilus—the curved cephalopod—was produced by evolution from the straight or uncurved cephalopod, and had taken this assumed fact as the groundwork of the theory of evolution, and as evidence of the truth of that theory and of its working. In his paper he, Mr. Pattison, had attempted to show that the one form was not developed from the other. With regard to the paper not having been printed before the meeting, he took that opportunity of saying that only a week ago he had received from Boston the latest utterances of Professor Hyatt, one of the greatest authorities on the subject, and as these were utterly at variance with the views that he himself had formed, he had been anxious to study them. He could only say that there were facts in the case about the inferences from which opinions would differ. Professor Huxley, no doubt, held his own opinions honestly, and he (Mr. Pattison) hoped that he did the same.

Mr. E. CHARLESWORTH, F.G.S. (a visitor), said that, having a large experience of the subject, he would like to make a few remarks. Professor Huxley's lecture, from which Mr. Pattison had read them some extracts, was intended to prove his theory of evolution as founded upon the theory—as they had heard—of the Nautilus and its connexion with the theory of evolution. The subject of embryology was nothing to the point. He had known Professor Darwin when he was a young man,—when the name of "Darwin"

* *Gospel of the Resurrection.*

was wholly unknown to the learned world ; but, perfectly apart from the interest which he therefore took in his theories, as springing from him, he took the greatest interest in this subject. He had read the abstract of Professor Huxley's paper with the greatest interest, but he had also read it with the greatest surprise. It seemed to him the production of a man of the very highest attainments in the scientific world. The subject was the "Nautilus." The common name that would be applied to its class was "shell-fish"; the proper name for it was "an organised mollusc." If they could imagine the living body of the mollusc, living in a trumpet divided by curtains thrown across it, and the creature always moving forward, and that, as it moves forward, it has no use for the small end and throws it away, this would be the straight form. Then, if they imagined another form, of which the shell was a curved trumpet, they would get the Nautilus. Professor Huxley then had told them that this curved form was an offshoot of the straight one. But the straight forms have been found living side by side with the curved ones,—as their contemporaries, and not as their ancestors. It was impossible that the one could be the ancestor of the other when they were thus found. If they went down through the London clay, and down to the deepest strata, they found there the Nautilus just as it was ages and ages ago. The two forms had co-existed as far back as they could be traced, and this showed that Professor Huxley's lecture had been a failure. But he (Mr. Charlesworth) hoped that the meeting would not take what he had said as a proof that he held that evolution is altogether a false theory. Though not a convert to the doctrine of evolution, he was not prepared to deny it altogether.

Mr. W. P. James said that he had unfortunately only heard a portion of the paper, but had been much struck with what he had heard as to the permanence of the forms under discussion. He could say nothing about the Nautilus, but on another branch—a kindred subject, Fossil Botany,—he would like to say a few words. Fossil botany was supposed to be weaker than the other branches of Palæontology, but it threw much light upon the subject of permanence of form. Botany did not produce anything so substantial as the bones and skeletons of animals or the shells of molluscs. If the conchological and other records were imperfect, he was afraid that the botanical was still more so. But yet it afforded much valuable evidence. If they went back to the Miocene flora they could not but be struck with the evidence of permanence they would find there. Poplars, palms, and many other trees were found there exactly the same as in the present day, the generic type being but very little changed. Every one could see that permanence and not variety was the most wonderful thing ; and this was emphasised by the fact that the climate had changed very much, since it was then most certainly sub-tropical. But to go further back, the mere fact that the type of the fern has remained so constant through the time that has elapsed since the Palæozoic coal measures that a mere child can recognise it, is astonishing. Botanists divide the fern group into three classes, popularly termed Ferns, Horse-tails, and Club-mosses. There had been a discussion as to some of these classes, but there was now a general agreement that, even at that very remote time, they were as distinct from each other as now ; and, if they had not changed during the long period during which we were thus enabled to observe them, it was absurd to argue that they could have changed to the extent that the theory of evolution required in the period that physicists allow to the world, for the three classes have never had the time necessary to develop from a common ancestor. If the theory of evolution were true, it should agree with the facts of botany as well as with those of zoology ; but it obviously fails to do so. Fossil botany was, he regretted, a neglected subject ; but eminent authorities had asserted that the facts it established disproved, or at least are opposed to, the theory of evolution.

Mr. PATTISON said that there was nothing in the remarks which had been made which called for any reply from him. He was very much indebted to Mr. James for his observations. They were very much to the point, and he had felt great pleasure in listening to an argument so strongly in favour of that which he had himself advanced.

The meeting was then adjourned.