771st ORDINARY GENERAL MEETING,

HELD IN COMMITTEE ROOM B, THE CENTRAL HALL, WESTMINSTER, S.W.1, ON MONDAY, MAY 22nd, 1933.

AT 4.30 P.M.

DOUGLAS DEWAR, ESQ., B.A., F.Z.S., IN THE CHAIR.

The Minutes of the previous Meeting were read, confirmed, and signed and the HON. SECRETARY announced the election of Albert Hooper, Esq., B.Sc., as a Student Associate.

The CHAIRMAN then called on Mr. G. F. Claringbull, B.Sc., who, in the absence of the author, had kindly consented to read Professor Albert Fleischmann's paper on "The Doctrine of Organic Evolution in the Light of Modern Research."

THE DOCTRINE OF ORGANIC EVOLUTION IN THE LIGHT OF MODERN RESEARCH.

By DR. ALBERT FLEISCHMANN, GR., Professor of Zoology and Comparative Anatomy in the University of Erlangen.

The Obsolete Roots of Darwinism.

THE earth, with its living creatures, is an indescribably great wonder. The more it is investigated in search of its secrets, the less comprehensible does it become. Yet our contemporaries, especially of the younger generation, have been taught to regard the riddle as solved. They believe that the animal kingdom has, by the natural selection of fortuitous little improvements during millions of years, reached ever greater and greater perfection. Following Charles Darwin, they regard all animal groups as branches of one gigantic tree. Few of them realize that this idea of Evolution belongs to the days of our grandfathers and great-grandfathers, while its roots pertain to the middle of the eighteenth century and stretch back to G. Leibniz. It is precisely for this reason, however, that the theory suffers from grave defects, which are becoming more and more apparent as time advances. It can no longer square with practical scientific knowledge, nor does it suffice for our theoretical grasp of the facts.

The manner in which the doctrine of organic evolution has fallen behind during the progress of events may be seen if we briefly review the growth of zoological knowledge. About two hundred years ago, K. Linné gave zoology its fundamental principles. A hundred years later (1831) Charles Darwin concluded a three years' tour round the world, returning to England with a rich store of new observations, and the rudiments of his theory, which, some thirty years later (1859), roused a delirium of enthusiasm in scientific circles, and finally afforded to the wider circles of both educated and uneducated society the illusion of a revelation of natural science.

Linnæan Classification.

Linné's principles of research are so simple and clear that they have unquestionably served to guide the work of all subsequent generations up to the present time. He insisted, in the first place, that statements should be limited to matters of actual fact, all play of the imagination being avoided. His second principle is implied by the title of his work (1735), named *Systema animalium*; for he held that the study of animals is facilitated by their proper arrangement—that is, by their synthesis (or grouping together) into genera, families, orders and classes, and their antithesis (or separation apart) into unlike animal groups. These two principles have served zoology throughout its great development during the last two hundred years. They have enabled the pupils of the great master to classify systematically not only the species known in his day, but also the vast numbers which have since been discovered; so that the arrangement of animals according to his system remains to this day the standard method of registering all special knowledge which we have acquired in regard to them. Anyone who would pass judgment on the correctness or otherwise of the doctrine of Evolution, must first master the details of this arrangement. For most of the laity such a task is impossible to undertake, owing to the colossal dimensions to which this classification has now attained. The first edition of his work, compiled by the youthful Linné, dealt with 560 animal species. After a century (1830), some 30,000 were included; and now, after another century (1933), about a million species. This fundamental work underwent a sudden expansion at the close of the first hundred years, owing to the recognition of fossils—which had long been known, but disregarded as *Lusus naturæ*—as the remains of once living types. They then had to be inserted in their proper places, among still living types, in the Linnæan system; and this gave new work to naturalists, and led to manifold observations being made on the characters of many strange animals which once lived on this earth in countless numbers.

Darwin's Dream.

Charles Darwin's youth was passed during the early years of this great expansion, and he received from it a strong impression which mastered his whole thought. He expected to find, in fossil types, much information regarding the origin of living things. He regarded fossil species as the ancestors of living ones, and dreamed of a *genealogical tree* embracing all species of animals, both past and present.

This fascinating dream has not, however, been confirmed by later discoveries, for the fossil fragments of extinct types are limited to their harder parts (bones, teeth, shells, etc.), while the softer parts have almost always been entirely lost. Hence the increasing mass of palæontological discoveries has only served to multiply our problems and emphasize our ignorance during the second hundred years, at the same time that increasing knowledge of the soft parts of living species, and of their minute structure, attained unexpected dimensions, and swept away the ground from beneath the feet of the evolutionists. Charles Darwin lived in a day when few people realized the value of detailed anatomical research in regard to Linnæan groupings of creatures; he consequently acquired comparatively little knowledge of anatomy, and never heard of modern anatomical methods.

The Progress of Anatomical Research.

Indeed, during the first hundred years of zoological work, anatomy had only played a subordinate part. Linné and his contemporaries had studied the outer appearance of the animals of their own and foreign countries, and arranged them according to similarities in such matters. Hence the early classifications were often based upon striking peculiarities of form, and single superficial features; study of the inner structure of the animals concerned being left severely alone. One might almost say that there was a general aversion to anatomical research at that time, although the great anatomist G. Cuvier (1769–1832) had insisted, soon after the death of Linné, that classification should be based upon internal details as well as on external ones. His chief supporters were found among students of human anatomy.

A revolution in methods during the second hundred years has succeeded in raising anatomical knowledge to the high status which it holds to-day. This is realized by experts, although the general public knows little about it. Hence few adherents of the doctrine of evolution realize how incompatible their shibboleths are with the leading modern concepts of animal anatomy.

A hundred and fifty years ago, detailed anatomical work was restricted to the study of the human body, and not extended to zoology in general. Instructions given to doctors of medicine was mainly in accordance with the syllabus drawn up by A. Vesalius (1514–1565) in 1543, which spoke of such organs as Bones, Ligaments, Muscles, Blood-vessels, Nerves, etc. Such a classification, based upon the structure of the human body, could not be utilized by zoologists in general, who had to deal with very different types of animals (Insecta, Crustacea, Echinodermata, Vermes, etc.). Cuvier had emphasized this fact in 1804, when he distinguished four main types or *phyla* of animals (Vertebrata, Articulata, Mollusca and Radiata). Only the first phylum* (Vertebrata) contains creatures whose structure is comparable with that of man; the other three phyla differ from it fundamentally. In spite of this, for many decades, the results of research in animal anatomy were still tabulated according to Vesalius's arrangement of organs. Ultimately, the latter was abandoned; but not until a great increase in knowledge had led to seeming correspondences being better understood, and anatomical divisions being more scientifically defined—and before this could happen, the whole technique of anatomical research had to be fundamentally altered and refined.

The New Methods and Concepts.

If one desires to study the inner constitution of animals, one can only do so by dissecting, or progressively dividing up their bodies, which resemble intricate shrines, until one resolves them

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* *See* Note, p. 209.

into many separate parts, and finds that they appear to be composed of separate organs. This dissection of bodies is so essential to their study that the whole process of research work on them is briefly termed a "Cutting up" (Anatomy). In place, however, of methods of dissection which had been followed from very ancient times, new processes and instruments were introduced during the second hundred years (1830–1930). At first there came the dissection of frozen bodies by means of a saw into what were still comparatively thick longitudinal and transverse sections; then followed an increased refinement whereby, with the help of a razor, very thin sections (0·5 to 0·002 mm.) of parts of bodies, and of small animals, hardened and embedded in paraffin, were obtained by the microtome invented in 1876. By this latter means the investigation of body structure was revolutionized. Instead of dealing with bodies divided crudely into thick masses, we can now examine long ribbons of sections, as thin as may be required, which expose the inner structure without materially disturbing its arrangement. This new method of cutting sections facilitated an excellent new method of dealing with anatomical material which, under the name of topographic anatomy, was first practised by doctors in England and France. The structure of the body was no longer regarded from the standpoint of isolated organs, but from that of body regions—head, trunk, limbs, etc. By this more enlightened practice, a method of dealing with bodily dispositions was adopted which had long been known to those who had to solve architectural, geometrical and mathmatical problems. Thanks to the *microscopically enlarged sections,* the eye of the research worker was also enabled to penetrate deeply into the minute structure of the body and discovered the fact, which had previously been unknown, that all animal structures are developed from special layers which recall the annual rings of trees.

The growth of knowledge of the *body layers* affords, in fact, the most remarkable feature in the progress of zoology during the second century of that science's existence. It provided rich material for new connections of ideas, to which Darwin and his contemporaries had been strangers. Likewise, the microscope disclosed the fact that all the body layers are made up of cells—tiny little building stones from 0·07 to 0·1 mm. in length. Owing to the thorough work of talented investigators, our knowledge of histology has increased to such an extent that anatomical relationships are regarded in a very different light to-day from that in which they were viewed during the first half of the nineteenth century.

The Importance of Ontogeny.

At the same time that these facts were being revealed, other pioneers of research, headed by K. E. von Baer (1792–1876), were showing that anatomical work should not be restricted to the fully-grown body, but that it was necessary to study sections of the body during *all* the phases of its existence (adult, youth, child and egg). When this is done, an extraordinarily manifold transformation-scene is witnessed, which runs throughout the whole life of every individual, and brings about great changes in both its inner and its outer form, often accompanied by changes in its geometrical proportions. Something of this nature had been noticed, during the seventeenth and eighteenth centuries, in regard to the easily seen changing life stages (egg, caterpillar, pupa, imago) of the Lepidoptera and other insects; and most surprising changes, from simple larvæ into highly complex adults, were now discovered among marine organisms.

Every year assiduous research work revealed more plainly that the course of every animal's life is, from egg to adolescence and even to death, one continual *tranformation*, be it rapid or slow. Earlier and later life stages often seemed quite irreconcilable (*e.g.* tadpole—frog, etc.) so long as only a few growth stages were known, separated by considerable intervals of time. But the greater the number of stages of the building up of the body that were placed in correct series, the greater became the knowledge of their regular logical sequence. A splendid revelation was thus obtained of the progressive building up of the body, governed by laws of space and time; and the sequence of life phenomena emerged from their former obscurity like a continuous cinematograph film, the individual pictures in which follow each other in necessary order.

Many great transformations are seen to take place; a tiny double cell, the fertilized egg, from 0·5 to 0·2 mm. in diameter, grows into a great adult creature weighing many hundred kilogrammes. The investigation of this marvel is far more profitable than making unverifiable guesses regarding the genealogical changes of long-extinct animal species of former ages, which are only known to us from bits of their skeletons.

Effect on the Concept of Species.

The concept of the *species* also received, during the course of the second hundred years, a new far-reaching significance, much beyond Linné's conception. It no longer signifies, to us, the constant form of a pair of adult individuals, but it rather represents the ceaseless flow of a determinate change in organization which, beginning with the simple spherical form of the fertilized egg-cell, is so strictly regulated for each species that one can actually wait, watch in hand, for the appearances of the destined form conditions. At first, simple structures begin to appear within the enclosed space of the egg. Soon they emerge from this, especially after food begins to be absorbed, and the tiny mass unfolds itself like a graduated series of concentric spheres into the form of a living animal. Exhibiting, at first, only a simple lace pattern, the fertilized egg-cell becomes, by progressive segmentation, or doubling, split up into an increasing number of cells (2, 4, 8, 16...128, 256, 512, 1,024). Then the cells arrange themselves into three *basic layers*, called "germinal layers," which enfold each other. In all the animal groups (except the Protozoa) a cylinder-shaped structure then arises, which consists of an outer single-layered wall (or tube) formed by a stratum of connected cells known as the *ectoderm*, beneath (or inside) which lies a mass of densely crowded cells called the *mesoderm*, and lastly comes an innermost single layer (or tube) of cells—the *endoderm*. Since these three germinal layers remain distinct throughout life, we are able to trace the subsequent development, from each layer, of the structures to which it respectively gives rise.

Fundamental Distinctions of the Phyla.

The new view-points stimulated, on all sides, assiduous research in the wide field of animal anatomy. The resulting well-grounded knowledge soon led to a complete change in ideas, which swept aside the old widespread notion of Darwin's day that the human body supplied the pattern for all animals, or, as it used to be said, that the organs of all members of the animal kingdom correspond to those of a dissected man (L. Oken); a preconceived notion which, by encouraging talk of "the ascending scale" of animal species, has led to great confusion. In place of this notion, the clear conviction arose that the Invertebrate phyla are, throughout their history, fundamentally different from the Vertebrata (including man), just as Cuvier had, with admirable insight, pointed out between the years 1795 and 1832. Now, in the year 1933, we actually recognize more than a dozen such groups of *fundamentally different* types of body structure, namely: Vertebrata, Arthropoda, Crustacea, Annelides, Rotatoria, Mollusca, Brachiopoda, Echinodermata, Tunicata, Platodes, Bryozoa, Coelenterata, Protozoa.

Had Darwin lived to witness this advance, he would have abandoned his illusion of a single great genealogical tree for all species of animals. The layman, however, could not formerly, and still cannot to-day, understand why the genealogical tree and the phyla conceptions are so irreconcilably opposed to each other, because he lacks the comprehensive knowledge, of the developmental phases of all the phyla, which would make this opposition clear to him.

The Reference Planes of Anatomical Measurements.

When once the recognition of *positions in the germinal layers* was realized to be the most important business of anatomical research, it became obvious that measurements of stereometric bodies had to be made with reference to the three chief planes (XX, YY, ZZ), in order to make proper comparisons of those bodies. Since the animal body has an outer *and* an inner aspect, and a curved instead of a straight boundary surface, the outer boundary is not taken into consideration, because of its extremely manifold modelling. All references are therefore made to the three chief inner planes. These are allotted definite positions in the body, in order to determine the relative distances of all points in the germinal layers, and in the numerous outgrowths from those layers. Most animals clearly bear, in their outer form, indications of the middle plane (ZZ) of the body, which is witnessed to by the mirror-like duplication of their right and left sides, so similar in shape, but developed in opposite directions. Owing to the discovery of the three germinal layers the work of measurement has been greatly lightened, because the body-complex is no longer regarded as a mass of organs, but as a co-ordinated combination of the three chief layers. One clearly sees how these germinal layer masses have developed similarly varying thicknesses on each side of the middle plane. Each layer shows a certain freedom in disposing of its mass; it may remove itself further from the three planes, or sink closer to them. In consequence of this, the layers are at times bent outwards to a greater or less extent; at other times they are bent inwards to form cavities, pouches, funnels, sometimes alternating with protuberances. There are, however, always fixed limits to their expansion in height, length and breadth.

The importance of the three chief layers has been incontrovertibly proved, particularly in cases where anatomical investigation has followed the whole course of life (egg to death), during which decisive changes of state follow one another in rapid succession. Reference to the three layers has the great advantage that the animal body is regarded as a whole, all regions and parts of it being equally observed, while the three chief planes only are taken into consideration.

Measurement Fixations of Growth Phenomena.

Just as the geologist reckons the strata of the earth by stages, so does the anatomist look for layer differences which characterize successive life phases. Traces of future structures first appear as exceedingly faint indications in the three-layered complex, and gradually develop into their final forms. All this results from the multiplication, often to an incredible degree, of minute cells which—except in rare instances—never become large enough to be seen by the naked eye. Indeed, this intricate cell structure of the body is one of the chief discoveries of the second hundred years. The more carefully we follow the developments of the three layers, with reference to the three main planes, the more clearly do we appreciate the strict order of bodily growth, down even to its minor details; while, at the same time, we also begin to realize even more clearly the wonderful regularity of body structures, which had previously only been recognized in regard to the segments and appendages of Insects, Arachnoids and Crustaceans. All this has contributed to emphasize the value of the new methods of treating animal anatomy by counting, reckoning, and (above all) by measuring.

It is due to the study of the three germinal layers that the structure of nearly a million species has now been fairly well elucidated, in contrast with the darkness which covered the subject a hundred years ago. We accept those three layers to-day as our means for accurately estimating likenesses and differences in the animal world. The new system insists that names, often incorrectly used in a universal sense (for example, eyes, teeth, stomach, lungs), should be restricted to the particular phylum; and it endows them with their proper meanings within the same. The head of an insect, for instance, has a very different derivation from that of a vertebrate!

The limits of the phyla, in comparing body structures, are now determined by the law of situation. He who measures the distances of important surfaces and regions from the main planes, obtains a true *group-picture* of the arrangements in species of all features which either grow out of each germinal layer like peninsulas, or else are detached as independent islands and become embedded in the middle layer. The idea of local relationships has prevailed over the conception of organs, which was universal in Darwin's time. The text-books of animal anatomy have likewise acquired a wider outlook, because the large body areas are now regarded as entities, and comprehensible pictures of the most important features of the phylum are thereby presented.

Resulting Whole-Life View of Species.

As compared with the obsolete methods of procedure of 60 to 100 years ago, the modern one has the advantage that it takes into consideration not only the fully developed body, but also all the stages of its growth, from egg to adult. This comprehensive review shows us that the foundations of the ultimate structure are laid down in the earliest stages of existence, and development proceeds, as if of logical necessity, to the preordained magnitude and final condition. The same identical sequence of earlier and later life stages repeats itself, in the case of each member of the species, just as if the process of bodily development clung to a rigid track, along which the germinal layer complex was compelled to travel during life, through a definite number of fixed intermediate stages to the appointed end. The course of life of every individual within the phylum traverses a special, native and unchangeable sequence of phases, which finally produces the fully developed body with all its parts. The wonderful regularity shown by the course of this development forbids the idea that the mode of growth within the phylum ever left one track in order to follow another. It is clear that, in supposing that existing species had sprung from other species, Darwin was only taking adult structures into consideration. In any case, Darwin's followers must now suppose that the developments of the germinal layers of earlier species underwent very frequent changes! But modern knowledge of the constancy of development shown by species lends no countenance to this.

There is no ambiguity about the general results reached by the clear-cut methods of modern anatomical research. One certainly sees, in the universal appearance of the three germinal layers and their regular placing with reference to the three chief planes, a general likeness in the structure of all species of animals; but we nevertheless find that those germinal layers perform different tasks in each phylum, according to the size and weight of the body and its inner and outer details. Thus the supporting structures required by the living body are formed, among insects, arachnids and crustaceans, from the outer layer, which produces a calcareous shell; among the vertebrates, on the other hand, the outer layer is unfruitful in this respect, all the masses of cartilage and bone of their skeletons being derived from the middle layer. It is certainly true that the calcareous plates and spines found in the phylum Echinodermata are also derived from the middle layer, but they are derived in quite a different manner. Hundreds of examples are known of the incredible differences to be found among the products of the germinal layers, according to the groups concerned.

The Added Certainty in Classification.

As the result of these investigations into the details of structure and developmental processes of animal bodies, many new characteristics have been added to the distinctions recognized by earlier workers, and have endowed the conceptions of zoological classification with an unexpected new element of certainty. Thus the hopes of Cuvier have been fulfilled during the second century of anatomical work, and Linné's efforts after classification have finally resulted in a system well grounded on anatomical facts.

Sound work on the structure and connections of the layers must begin by dealing with groups of the most closely related species. This reveals the regularity and wonderful individuality of the development of each species, and habituates the mind to think more and more in terms of anatomical group measurements. Broad facts which Cuvier outlined 130 years ago are now practically illustrated by group-pictures of the growing layer connections and chief tissue complexes during the whole life-history of individual species; and such evidence affords a firm foundation on which to base our arrangement of species, each according to the wonderful shading of its common group features, into well-selected higher groups of like forms (genera to classes). The phyla thus constituted usually agree, in general, with improved groupings under the older system of classification. Every recent handbook of Zoology places the classes within the phyla so delineated (for example, the Coleoptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera, Orthoptera, etc., among the Insecta), and the lesser groups within the classes, down to the individual species group. If an arrangement originally based upon external adult features agrees so well (in a general way) with our later classification based on the whole developmental history of structures, inner as well as outer, it would seem to imply that those thinkers are right who regard the animal body as a *wonderful self-contained work of art.*

Phenomena of Layer-Combination.

Modern anatomy clearly emphasizes the indivisibility of the parts of the body at all times, past and present. Cuvier designated this the "Correlation" of the parts; E. Geoffroy St. Hilaire styled it their "Connection"; I myself have hitherto called it the "Layer-Combination" ("unlösbaren Lageverband"). This expression indicates the fact that anatomical structures cannot be regarded as results arrived at by accumulations of little accidents, but that each is a superhuman work of art, living, regulated enigmatically by strict laws, and itself conserving and producing new life forms.

Specific Constancy Unaffected by Variation.

Study of the higher groups reveals a striking regularity, which was unknown 100 years ago, and which, in view of the rules of position and form which are obeyed down to the smallest details, lends no support to the idea that the strict laws of one species could be changed, by means of minute fortuitous variations, into the structural laws of another species. Seventy years ago, Darwin could talk as if varietal differences tended to "change the species," and such talk met with approval; but since the strict orderliness of development has been discovered, the assumption of an evolution of species has encountered insuperable difficulties. No one can demonstrate that the limits of a species have ever been passed. These are the Rubicons which evolutionists cannot cross. The fact of *variability*, on which Darwin based his ideas of fortuitous differences linking allied species, is countered by the sobering fact of the *law of variation*, which expresses the fundamental agreement of measured characters among the members of a species, as known from the statistics of variations during the last decade. This shows that the variations are centred round a mean value in the form of the binomial curve which represents the law of averages, and is constant and true for one species, but not for related species. The question, therefore, is not whether the species is variable or invariable. The essential point is that the concept of the species is based upon the *regular* destiny which is inscribed on the three germinal layers, and the place-form peculiarities of their complexes in the course of life of the individual. Thus accident, caprice and arbitrariness are eliminated from zoological discussion.

Incongruity of the " Genealogical Tree " Concept.

In the same way, the altogether useless concept of the animal *genealogical tree* is found to disappear. It affords no satisfactory picture of the relationships between the million living species of animals and the 120,000 known extinct species. For the last 70 years evolutionists have discussed hundreds of supposed ancestral derivations, without having agreed about a single one. Attempts to blend together the characters of the fourteen different phyla into one hypothetical common stock only result in producing an opalescent pattern of body structure, which proves nothing for the common origin of those phyla.

The so-called pedigree of the animal kingdom is utterly unlike the genealogical trees of human families, because the latter deal only with members of one species, whereas the former include multitudes of different species and postulate countless purely hypothetical links between them. Even the shortened genealogical trees found in popular writings are apt to dognatize about the derivations of whole phyla—that is, of anything from 2,000 to 100,000 species at a time.

The family genealogical tree shows a limited number of names, arranged in the semblance of a tree, of people actually known to have been related by descent. It is a compilation of facts, like a dictionary. Nothing resembling it is known regarding species connections. When we come to discuss the latter, we are no longer dealing with first-hand evidence (*i.e.* with verbal or written traditions) as to the connections concerned. All is hypothesis. We postulate long ancestries simply because we do not know the real ones, and because creatures have to be accounted for somehow. We note the incontrovertible fact that new creatures, born every year, experience the same time- and form-regulated fate as their parents; hence the sequences we see are obviously links in chains of organisms of which neither the beginnings nor the ends are visible to us. But that does not justify us in supposing that, just because each individual changes in form while developing from childhood to adolescence, therefore its remote ancestors must have changed from one species into another. Again, even when we deal with the members of a single existing species, we find it impossible, on purely anatomical grounds apart from historic testimony, to demonstrate the connection between individual parents and their offspring. Among animals, the father is apt to disappear nameless among the multitude of his species, after taking his brief part in procreation, and science is powerless to re-identify him. Despite these facts, evolutionists search for "ancestors" in the graveyards of the past, and arrange fossil fragments (*e.g.* leg bones, teeth, or skulls) of various extinct species of horse into hypothetical series, and—in complete disregard of the rules of group-position and form—believe that these represent real ancestries. Yet the facts which they quote go no further than, for example, the science of malacology went 200 years ago, when only empty shells were examined. Malacology has long grown out of that stage, owing to our increased knowledge of the soft parts of shelled animals; but palæontologists, whose researches are of necessity confined to the hard parts of extinct species, still know nothing about the minute cell-structure of those species.

Nothing is gained by glib talk about "ancestors," "stem-parents," "ancient progenitors," etc., as classificatory concepts of extinct species, on the supposition that evidence to prove the truth of those concepts will be found later on. Our hopes in this respect are very remote, especially in the case of the thousands of species of minute creatures whose tiny bodies rapidly decompose after death and leave no enduring hard parts.

Conclusion.

A survey of the history of zoology thus reveals an actual situation very different from that generally claimed by the advocates of evolution. The business of classifying animal species began, in 1735, with very little knowledge. During the course of the second century since that date, however, about a million species have been mastered by means of a detailed study of their major and minor body structures throughout their development from the egg, at the same time that incontrovertible methods of measuring the degrees of likeness have been invented, and the unvarying form and time stages of the life of animals have been discovered. On the other hand, the study of palæontology has not fulfilled the hopes that Darwin and his contemporaries placed in it. As it happened, they found themselves in much the same condition in regard to palæontology, 100 years ago, as Linné had found himself, in regard to zoology, a century earlier. He had little knowledge to begin with, although zoological science has since so greatly expanded. But palæontologists are still confronted by the fatal difficulty that their field of research lies in the graveyards of the buried past, instead of in the living world which continually renews its youth. While attempting to deal with similar problems, the palæontologist has only a skeleton to work upon, while the zoologist can study the entire animal in the full vigour of its existence.

This limitation of the palæontological field of research can obviously never be removed, and the very antiquity of the fossiliferous strata precludes our attaining certain knowledge regarding the animals which lived while they were being laid down. All that we can do is to group the fragmentary remains of these animals as best we may, after careful examination of all the available evidence, together with existing species. It is obvious that we can never compare their minute structure with that of living things, or with that of other fossil types. In other words, we can never hope to attain adequate knowledge of the fossil world, much less can we prove its evolution.

Seventy years ago, Darwin ransacked other spheres of practical research work for ideas. In particular, he borrowed his views on selection from T. R. Malthus' ideas regarding the dangers of overpopulation, to which he added the facts recorded by breeders regarding the variability of domestic animals, the results of artificial selection of the best pairs in herds, the pedigrees of domestic animals, and the improvements of existing races and the development of new ones, etc. In order to adapt these things to a theory of wild life, he then added the very reasonable concepts (in J. Kant's opinion) of the struggle for existence and natural selection. But his whole resulting scheme remains, to this day, foreign to scientifically established zoology, since actual changes of species by such means are still unknown. On the other hand, our greatly increased knowledge of specific anatomy throughout life, as well as the new variation statistics and our increased knowledge of Mendelian laws, have all tended —especially within the last 30 years—to accumulate evidence against Darwin's theory.

In my opinion, the most serious defect in the Darwinian school of thought is that it is not based on the knowledge of rigid law. No matter how much eloquence the advocates of Evolution may pour forth, they will not cancel the facts briefly outlined above!

[*Note.*—It is unfortunate that the word "phylum" should imply that very concept of a genealogical tree to which this paper takes exception. To substitute another and less familiar term might, however, lead to misunderstanding, since "phylum" has now acquired such definite significance, in classification, as referring to one of those great sections of the animal kingdom whose fundamental structural designs are so distinct from each other. The term "phylum" is therefore retained in this paper; but it should be clearly understood that it is here used in the sense only of a great *division* of organized beings, and not as implying any doctrine of common genetic origin. All modern research emphasizes the distinctions not only between the great divisions themselves, but also between the subdivisions of which each is composed; and it shows the absence of all factual grounds for postulating genetic connections between them.]

DISCUSSION.

The CHAIRMAN (Mr. Douglas Dewar) moved that the thanks of the Institute be given to the learned author of the paper, and the same was accorded with acclamation.

Rev. Dr. H. C. MORTON said: We have listened to a really notable paper by one of the world's great zoologists, who, especially in the light of anatomical research, finds only one course open, viz., the emphatic and unfaltering denial of the "illusion" of Darwinian Evolution, and of "the fascinating dream" of the genealogical tree of the Doctrine of Descent.

I am not an anatomist, and even if I were, this occasion lends itself but little to technical discussion. But there are two things I want to say. The first is that it is worthy of note that Professor Fleischmann does not trouble to distinguish between Darwinism and Evolution in general, but evidently treats Darwinism as the