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720TH ORDINARY GENERAL MEETING,

HELD IN COMMITTEE ROOM B, THE CENTRAL HALL, WESTMINSTER, S.W.1, ON MONDAY, MARCH 4TH, 1929, AT 4.30 P.M.

SIR AMBROSE FLEMING, D.Sc., F.R.S., IN THE CHAIR.

The Minutes of the previous Meeting were read, confirmed, and signed.

The CHAIRMAN then introduced Dr. A. Rendle Short, B.S., B.Sc., F.R.C.S. (himself a member of the Council of the Victoria Institute) to read his paper on "Some Recent Literature Concerning the Origin of Species." Before doing so, Dr. Short offered congratulations, in which he knew all would concur, to the Chairman on the honour of Knighthood which His Majesty the King had been pleased to confer on him.

SOME RECENT LITERATURE CONCERNING THE ORIGIN OF SPECIES.

By A. RENDLE SHORT, ESQ., M.D., B.S., B.Sc., F.R.C.S.

IT will be necessary at the outset to make it clear what the writer's standpoint is. It has come to be widely believed that there is an inevitable and hopeless clash between the facts of biological science and reasonable deductions therefrom, on the one hand, and, on the other, the course of events as set forth in the earlier chapters of the Bible. It has therefore become a commonplace to regard the one as all wrong and the other as completely reliable. Popular science, with the eager

concurrence of liberal theology,* regards the Darwinian theory as completely proved, and relegates the Genesis account of the Creation to the category of myth and folk-lore, totally useless as a record of facts. Some stalwart Fundamentalists, in their turn, have little use for the discoveries and less for the theories of biological science, and strongly suspect wilful falsification. Neither of these parties will find much to interest them in what follows. We are persuaded, however, that there is a considerable body of opinion ready to agree with us that the truth usually lies between two extremes; that it is never safe to neglect any source of information; that the Bible bears too many marks of being the Word of God to be treated as mere folk-lore, but that it is hopeless and misleading to bring wholesale charges of inaccurate observation and deduction against all the students of natural science. It is our present purpose to attempt to show that there has arisen a school of biologists whose conclusions are not so difficult to reconcile with the Genesis narrative, as were the teachings of Darwin, Huxley, Haeckel, and the rest.

Let us approach the subject historically. Up till the end of the eighteenth century, there was fairly general agreement with the barest and most literal interpretation of Genesis and with the chronological deductions therefrom, by Usher or Hales, that the world, the sun, and the moon were created in six literal days, about 4,000 years before the Christian era. As the new-born science of Geology became better known, and evidence accumulated of the immense antiquity of the rocks and of the fossils contained therein, room was found for this by a reinterpretation of Genesis which put a great gap between the first and second verses in Gen. i. Then came Darwin and Wallace, followed by Huxley and Haeckel, and there emerged the theory of Evolution by Natural Selection, which practically eliminated the necessity for a Creator in the world of living creatures; though this was not Darwin's original opinion, and Wallace, in his last book, *The World of Life*, came forward with a notable argument for Theism. The conflict between Huxley and the older theologians was acute, and this was the period

* For which eager support the scientists appear to be none too grateful. Thus, J. T. Cunningham (*Modern Biology*, p. xi), referring to the Bishop of Birmingham, says: "It seems to me that he is unconsciously encouraging dogmatism in biology, while he repudiates it in theology."

when, as it was wittily remarked, " bishops had sleepless nights when they heard of a very hairy man, or a particularly intelligent ape ! "

The main contentions of the theory of Evolution by Natura Selection were :—

(i) That all forms of life, fossil and recent, animal and vegetable, including man himself, were derived from one (or very few) very simple, original form, like branches and twigs spreading out from the bole of a parent tree.

(ii) That the effective force in bringing new species, genera, families and orders into existence was Natural Selection. That means that all (or nearly all) living things show incessant variations from the normal : some of these variations chance to be helpful to the organism in the struggle for existence, and their fortunate possessors are more likely to survive and to pass on their happy improvements to their offspring, so that a new and better species gradually supplants the older one, as the descendants of the one or two favorites of fortune crowd out their less enterprising and poorer relations. Brilliant colouring and some other characters were attributed to sexual selection.

The main arguments for the theory were :—

(i) *Variation and Domestication.*—Extraordinary modifications have been brought about by human selection in animals and plants under domestication. Witness, for instance, amongst pigeons, the pouter, the fantail, and the tumbler, derived by breeding from the wild rock-dove ; and the countless varieties of modern roses.

(ii) *Island Life.*—There are marked modifications of plant and animal life inhabiting distant islands, certainly or apparently derived from mainland plants or animals, but showing such differences that they have to be described as new species and genera. Examples include the giant tortoises of Galapagos Islands, with a different species on each island. More striking still is the persistence in Australasia of whole groups of animals rarely to be found elsewhere, representing the fauna of past geological ages : for instance, the marsupials, Monotremes (*e.g.* duckbill platypus), shellfish (Terebratula, Trigonia), and air-breathing fish (Ceratodus) of the Mesozoic period, and the absence of other mammals, except recent human introductions.

(iii) *The Argument from Geology.*—In general terms, the fossils in the newer rocks represent forms progressively more complex than those in the older. Thus we find Crustacea in the oldest (Cambrian), fish next (Silurian), mammals later (Rhætic), and man last. Occasionally a series of closely connected forms, with all the intervening links, can be traced as we study the fossils in a succession of geological strata, lying the one on top of the other. That such series are not the rule, but the very rare exception, is attributed to the imperfection of the geological record—that countless forms perished without a memorial.

(iv) *Mimicry.*—In a few special cases, *e.g.* when for purposes of self-protection a creature closely mimics inanimate objects (*e.g.* the stick insect, butterflies with wings like a leaf), or a harmless and edible insect such as the hover-fly develops black and gold bands like a wasp, it was easy to conclude that natural selection might be operative in perfecting the mimicry. The less successful imitators would be detected and eaten by enemies.

(v) *Law of Recapitulation.*—Haeckel emphasized his Law of Recapitulation, that the embryology of every animal (ontogeny) is a condensed version of its ancestry (phylogeny). That in their individual development mammals, including man, begin as a one-celled ovum, and pass through a stage with gillarches, is taken to prove that in past time the precursor of the mammals was first a one-celled organism like Amœba, and later a fish.

(vi) *Vestigial Remains*, and occasional freaks, in animals, such as the rudimentary pelvic bones of whales, now serving no obviously useful purpose, are alleged to prove derivation from an ancestor which had a use for the organ now nearly lost.

After the early conflicts with theologians had died down, the great majority of scientists came to accept all this without question, and saw no difficulties in the way. Of late years the criticisms of orthodox Darwinism have increased thick and fast, but probably there is still a majority, though not of the most active minds, who hang on to it grimly.

"It was Bateson who showed us there were difficulties in Darwinism, that the problems of Evolution were far from settled" (D'Arcy Thompson [1]).* He rediscovered old Abbot Mendel experimenting with tall and dwarf peas, and proving that variations are not due to chance, but follow a well-defined

* See references, p. 159.

law. "The great growth of our knowledge of genetic constitution, derived from Mendelian experiments, so far from clearing up the question of the origin of species, has only shown that our old Darwinian conceptions are unproven, and that all is again in the melting-pot" (Scott [2]). Bateson pointed out that the reason why such amazing variations can be secured with domesticated animals and plants is because they are usually hybrid in origin, *e.g.* modern dogs are derived from the wild dog, the wolf and the jackal. Almost the only widely varying cultivated flower that comes of a pure stock is the sweet pea. [3]

We may refer here to the work of Tornier [4] on the goldfish. A visit to a fresh-water aquarium will introduce us to many strange varieties (the "veil-fish," the "bullhead," etc.) derived from the goldfish by Chinese breeders, but Tornier shows that all these modifications can be explained by the effects of oxygen starvation on the fish embryo. In other words, most "fancy" varieties of domestic animals and cultivated plants are pathological, due to some defect, and would stand no chance of survival in a state of nature. It is evident that here one of the main props of Evolution by Natural Selection falls away.

For a moment it appeared that de Vries, who observed the sudden appearance of a new variety of Evening Primrose, had solved the problem of the origin of species by his Mutation Theory. But it has since become clear that these mutations, too, are pathological freaks (Scott [5]). The number of chromosomes (the elements which carry the inherited characters, and which should be constant in number) in the germ-cells of his evening primrose was anomalous. Professor T. H. Morgan has bred a number of very curious modifications of the banana fly (Drosophila), which often provide excellent illustrations of Mendel's Law, but they are not new species. In the main, they show defects, either of the eyes or of the wings.

Weissmann [6], seeking to establish Natural Selection, yet dealt it a well-nigh mortal blow by showing both on theoretical and experimental grounds that acquired characters cannot be inherited. For instance, the children of parents both blinded by accident will have normal eyes. The habit of foot-binding for many generations amongst Chinese women has not led to any inherited deformities of the foot. How could such acquired defects possibly influence the germ-cells in the sex-glands? Experiments on plants and animals confirm. If from a handful

of "pure line" beans the smallest are chosen from which to raise a crop, the resulting beans will be normal, not small (Johannsen*). Similar results have been obtained with a waterflea (Agar*) and paramœcium (Jennings*). Thus, Natural Selection, as Berg and others point out, does not tend to advance the race along some definite direction, but to crop off every deviation from the normal standard. So far from producing a new species, it effectually preserves the old one. Immense efforts have been made, with very indifferent success, to prove that acquired characters *can* be inherited. The nearest approach to success, amongst innumerable failures, is perhaps Kammerer's [8] conversion of a yellow into a black salamander, and vice versa.†

The features that distinguish a species from its relations are by no means always helpful in the struggle for existence, rather the reverse, yet natural selection has suffered them. Berg [9] gives pictures of various excrescences in insects which can serve no useful purpose, and must rather be a handicap. Even when a perfected organ is of value to its possessor, *e.g.* its electrical organ to the electric eel, it is impossible to see how the earliest stages could have been of any survival value, assuming as Darwinism does that these stages were gradual. "The non-utility of specific characters is the point on which Natural Selection, as a theory of the origin of species, is believed to fail" (Scott [10]).

Palæontology (study of fossils) has made great strides since Darwin's time, and it is futile nowadays to lament over lost evidence from the imperfections of the geological record, when so many undisturbed and highly fossiliferous strata have been thoroughly explored in a vertical direction. The general results are as follows. Many of our modern plants and animals can be traced far back in geological time. Living genera of mammals can be found in Miocene formations, and living species in the Pliocene. Of 147 species of Pliocene plants, all found before the Ice Age, and including the violet, buttercup, blackberry, colts-

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* Quoted by MacBride [7].

† Professor Kammerer committed suicide in 1926 at Vienna, because it had come to light that some of his published results (of experiments on toads) were fraudulent. Apparently he had been imposed upon. Some experiments by Pavlov on mice are often advanced as proving inheritance of acquired characters, but more recently (1927) the very distinguished and conscientious author seems inclined to withdraw them.

foot, etc., all but 30 are still growing in this country (Clement Reid). The walnut, oak, plane, and maple go back as far as the Chalk (Scott [11]). The Nautilus is very old, and a shellfish (Lingula) may be found to-day practically unchanged from the earliest fossiliferous beds (Cambrian). Occasionally, especially in the Oligocene of the Colorado district of the U.S.A., skeletons of an animal can be recovered from a vertical succession of different layers, and a continuous series of slight changes in a definite direction made out, *e.g.* reduction of toes and increasing complexity of the teeth. A few series of Ammonites, or of Gastropods, have been described, behaving in the same way. But the all-prevailing and dominating feature revealed by Palæontology is this—we find in a particular stratum thousands of forms of some fossil all exactly alike, then, perhaps only a few inches above, it has been entirely replaced by a more or less similar but different form, as though a mass-transformation of the one species into the other had taken place. This was first emphasized by Waagen [12]. The changes, as we follow a species upwards into newer strata, are all in a determined direction, although they advance by leaps. Osborn [13] remarks that this is the greatest contribution which Palæontology has made to Biology and Natural Philosophy, and that it was "unknown to the master-mind of Darwin in 1845–58."

Grand 'Eury, who had worked for a quarter of a century at the fossils of the French coalfields, and who began by expecting to find a continuous variation, says that his researches "suggest the idea that their mutations have acted in the manner of metamorphoses, or even perhaps, in opposition to the well-known axiom, by leaps." Zeiller, another distinguished palæobotanist, came to the same conclusion. (*See* Scott [14].)

Berg shows that there is a similar phenomenon exhibited in different geographical regions by several kinds of fish to-day. In Southern Europe, chub, roach, etc., have fewer rays in the fins than in Northern Europe, for no obvious reason. The same observation may be made about geographical variation in birds. The red grouse of Scotland seems to represent the willow grouse of Norway. Again, time may witness widespread changes in a species; thus, musk appears to be losing its scent the world over.

This evidence is all against the theory of Evolution by Natural Selection; that a favoured few became improved little by little, and gradually ousted the rest. As a rule it is impossible to see

in what way the new, superjacent forms are better fitted for life than the older, subjacent. After all, fossils were mostly denizens of the sea, and conditions in the sea do not change much. Life in the sea makes for stability, not constant adaptation to new circumstances.

Again, Palæontology shows us that quite ancient forms may be very complicated and highly modified, sometimes even more so than their modern representatives. In such cases there is no evolution from the primitive to the more highly organized. For instance, the Trilobites of the oldest (Cambrian) fossiliferous rocks are as complex as the modern crayfish. The seed-bearing ferns and club mosses of the Coal Measures are much more highly developed than modern ferns or lycopods.

Fossil plants are known from the Devonian rocks, older even than the Coal Measures, with all their internal structure wonderfully preserved and capable of microscopical study. Some of them are highly developed and specialized, including big trees. Others are relatively simple (*e.g.* Rhynia), but so are many modern plants.

The Recapitulation Theory.

That the affinities of an animal may occasionally be shown better by its embryonal stages than by the fully grown form is unquestionable. Thus, some toothless whales have teeth in the fœtal state. Sacculina, apparently a very lowly parasite, is proved by its larval stage to be a degenerate Crustacean. But the evidential value of the theory is greatly clouded by what Balfour calls "falsifications of the records." The alleged ancestral stages in various life-histories seldom correspond to any real proved ancestor. For instance, the earliest known Crustacean is the Trilobite, found in the Cambrian, which is segmented, but the embryo (Nauplius) of the modern Crustacea is not segmented. The early embryo of the Spiders is segmented, so if the Recapitulation Theory is to be trusted, the Spiders and Scorpions on the one hand, and the Crabs and the Lobsters on the other came by totally different ways, which is a very unwelcome conclusion to the zoologist. How absurd it would be to conclude that because a butterfly passes through the stages of caterpillar and of chrysalis, that therefore, at some remote geological period, the ancestors of butterflies were motionless, unsexed, not feeding, composed of a creamy mass of cells showing no organs

at all (except in the tiny embryonic area) like a modern chrysalis! Another of the difficulties of the Recapitulation Theory is instanced by Garstang [15], who remarks that before it can leave a trail for a new species derived from it to recapitulate, an animal has first to follow up the track of its own development (ontogeny) and then to add something more, which is absurd.

The theory does not fare any better, but rather worse, at the hands of the botanists. "The so-called law of recapitulation might be assumed to apply less stringently in plants than in animals, and detailed comparison shows that this is actually the truth" (Bower [16]).

Professor V. L. Kellogg [17] says: "The proof that man is descended from a fish because he has gill-slits at one period in his individual development is not of the sort to rely on too confidently. The recapitulation theory of Fritz Müller and Haeckel is chiefly conspicuous as a skeleton on which to hang innumerable exceptions. . . . The recapitulation theory is mostly wrong." H. Bergson [18] said: "It has been necessary to reject the almost classical theory of the specificity of embryonal gills." Professor A. Sidgwick, in the article on Embryology in the *Encyclopædia Britannica*, writes in a similarly cautious strain.

Convergence.

Perhaps the most remarkable modern contribution to the problem of the Origin of Species is by Dr. Leo Berg, a professor in the University of Leningrad. His book, called *Nomogenesis*, or Origin by Law, was published in English in 1926. He summarizes some of his conclusions in contrast to those of Darwinism, as follows [19]:—

Darwinism.	*Nomogenesis.*
(1) All organisms have developed from one or a few primary forms, *i.e.* in a mono- or oligo-phyletic manner.	(1) Organisms have developed from tens of thousands of primary forms, *i.e.* polyphyletically.
(2) Subsequent evolution was divergent,	(2) Subsequent evolution was chiefly convergent (partly divergent),
(3) based on chance variations,	(3) based on laws,

(4) to which single and solitary individuals are subject;	(4) affecting a vast number of individuals throughout an extensive territory;
(5) by means of slow, scarcely perceptible, continuous variations.	(5) by leaps, paroxysms, mutations.

The evidence for Berg's conclusions is enormous, and ranges so widely over Zoology, Botany and Palæontology that to do it justice here is difficult. One of his main points is the abundant evidence in Nature for what is called Convergence, that is, two totally unrelated forms of animals or plants may come to present a strange similarity. Everyone, Darwin included, has had to make some allowance for Convergence; Berg sees it everywhere. The deduction, of course, is that *resemblance is no proof of relationship or inheritance*, a deduction which cuts away the root of all the tables of ancestry (phylogeny) of living things. Only a very few of Berg's illustrations of Convergence can be given:—

(i) The spermatozoon of vertebrates, *e.g.* toad, is, down to minute details, like a free-swimming, lowly form of life called Trichomonas. But no one imagines that vertebrates are descended from Trichomonas.

(ii) The extinct (Mesozoic) plants called Bennettitales show a sort of flower, with male and female elements and pollen, but they are Gymnosperms, allied to modern Cycads, and cannot possibly be ancestors of modern flowering plants.

(iii) The Coal Measure "ferns" are very like our modern ferns, and were long supposed to be their ancestors. But they are now proved to be reproduced by seeds, not spores; *i.e.* they are far higher up in the scale than modern ferns, and can in no sense be ancestors.

(iv) Common wheat exists in several varieties, bearded and beardless; white, red or black-eared; winter and spring. But just the same varieties are found of other wheats, spelt, rye and barley. This must be an inherent law of the grain; it cannot be chance.

(v) The Dipnoi (air-breathing fish living in mud or water) cannot be the ancestors of frogs, toads, etc., but they share with them the paired lungs, the partitioned auricle (of the heart), and many other characters. That both Dipnoi and Amphibia

should "by means of accidental variations of characters" change over from breathing by gills to breathing by lungs is "a miracle no naturalist ought to credit" (Berg).

(vi) The octopus has eyes just like a vertebrate, with cornea, iris, ciliary body, lens, and retina; but it is not an ancestor. Lowly vertebrates have no eyes (amphioxus) or a very elementary eye (the hag). Darwin himself was staggered at his own proposition that so complicated a structure as the eye was brought about by accidental variations. Is it credible that chance has worked this miracle also, both in the octopus and in the vertebrate?

(vii) Three types of fish, the electric eel, torpedo and Malapterurus, can give powerful electric shocks, but they are quite unrelated.

(viii) The claws of a lobster and of a scorpion are on the same pattern.

One of the most remarkable examples of Convergence is furnished by the marsupials (pouched mammals of primitive type) of Australasia. There are forms that mimic most of the common types of the mammals of Europe, Asia and Africa. There is a volplaning opossum like the flying squirrel or flying lemur, the flesh-eating Thylacine like a wolf, another marsupial like a rat, another like a jerboa, another like a shrew, another like a mole, and another like a bear!

Nor is it only in outward form that Convergence is seen. The crocodile, like the bird, has a four-chambered heart. The extinct flying lizard, the pterosaur, had air-filled bones, and the foramen admitting the air situated just where it is in birds.

Other modern writers besides Berg are impressed by Convergence. Bower points out that both plants and animals are bisexual, but it is scarcely credible that they have a bisexual common ancestor. Osborn [20] calls attention to the strange parallelism between extinct reptiles and modern mammals; the huge dinosaurs with horns (Triceratops), like a rhinoceros; Ichthyosaurus, like a whale; pterosaurs, like a bat; flesh-eating Cynodonts with teeth like a dog; iguanodon, walking on its hind legs and tail like a kangaroo; the turtle, armour-plated like an armadillo or the extinct glyptodon. Surely all this must be law, not chance. Especially when we find that each of these types requires not one, but many, coincident modifications; *e.g.* the heavy-headed rhinoceros must have massive

legs and a strong neck; the flesh-eating Thylacine, the wolf, and the extinct Cynodont must have the agility to hunt their prey. Many examples of Convergence, besides those mentioned by Berg, will occur to the reader (an excellent token that the exponent of a law is on sound lines). Man and the parrot (and a few other birds) share the power of articulating. The frog, the squirrel and many other totally unconnected forms hibernate in the winter, which necessitates several complicated physiological adjustments to avoid starvation.

The trump-card of the advocates of Natural Selection is Mimicry for purposes of protection. Berg shows that the argument has been greatly overstated. Nearly all the alleged cases break down on strict enquiry, and prove to be examples of Convergence. Does anyone, for instance, really suppose that a bird is deterred from eating a mosquito for fear it may get stung? If not, of what advantage is it to insects, such as Cheironomus, to mimic it? Or take Wallace's classic case, the butterfly *Papilio polytes*. It now transpires that the mimics and the mimicked are not found in the same locality. The "imitated" forms, amongst insects, are usually not worth imitating; they are often eaten by birds quite readily. And are birds such fools as to be so easily taken in? It will be remembered that Darwin found that ants always detected and killed strangers put in their nests, while accepting their own kin even when steeped in asafetida. Some harmless snakes in Central America are black-red-yellow, like the poisonous Elaps. This was described as an admirable example of Mimicry, until it was discovered that they were all nocturnal.

Polyphyletic Origins.

Berg's next main point is that attempts to derive animals (or plants) from extinct common ancestors almost invariably break down. He gives numerous instances of such attempts, but it nearly always turns out that the supposed common ancestor is in some way more complicated than its alleged descendants. Thus, all the varieties of modern ferns used to be derived from the so-called ferns of the Coal Measures, but we know now that these were seed-bearing plants, much higher up than our modern spore-bearing ferns. Even in the earliest fossiliferous rocks (Cambrian), there are already three quite distinct groups of Brachiopods (shellfish) with no evidence of a common ancestor.

The number of classes and orders of plants and animals described by naturalists is constantly increasing, because authors realize the impossibility of deriving one group from another. Thus, in Darwin's time, there were six sub-classes of fishes, now there are at least ten. Here again Berg's conclusions are powerfully supported by distinguished British scientists, and especially by the experts on fossil plants. Scott [21] remarks that in Cretaceous times Angiosperms (flowering plants) "appear suddenly, in their full strength, like Athene sprung from the brain of Zeus. We know nothing of their evolution." Seward believes that the Mesozoic plants were entirely new formations, not descended from Palæozoic forms at all. "Persistence of a type, and from time to time the apparently sudden influx of new types, rather than a steady progressive development, are amongst the outstanding features of the history of plant evolution" [22]. Scott [23] adds: "We are compelled to face the conviction that we really know very little of evolutionary history." Bowers [24] writes: "The present view of the lines of descent for vascular plants is more like a bundle of sticks than a connected tree. . . . The morphological problem of descent is regarded by many as being again in the melting-pot." We may sum up in the words of D'Arcy Thompson [25]: "How species are actually produced remains an unsolved riddle; it is a great mystery. Here at least is a conclusion that few men of our time will venture to dispute." And again, with the great authority of H. F. Osborn [26]: "Darwin's law of selection as a natural explanation of the origin of all fitness in form and function has lost its prestige."

Origin of Man.

So far we have been considering the Origin of Species in general, but without doubt the species whose origin is of the greatest interest to us all is *Homo sapiens*. And if it be true, as Berg puts it, that there have been tens of thousands of original forms of life, or, to use Bower's analogy, that the descent of living things is better represented by a bundle of sticks than by a tree with branches, it is more than probable that Man has had one of these separate origins. If Convergence is so prevalent in the animal kingdom, it will suffice to account for the anatomical and physiological resemblances of the human body to that of other mammals, and notably the anthropoid apes. Even the resemblance between human and ape blood may be thus

explained, for, after all, it is only a resemblance, a common reaction to certain tests. No sane physician would dare to transfuse an ape's blood, in bulk, into a living man.

It is often maintained that man's body contains numerous functionless relics which can only be accounted for by his animal ancestry, but these dwindle to little or nothing on examination. Certainly there are atrophic glandular structures, like the thymus and pineal, but they appear to function in infancy. There are functionless relics in the adult male, and in the adult female (*e.g.* mammary glands, parovarium) that function in the opposite sex, but that is not to the point. The coccyx is the homologue of the tail in animals, but it is not functionless, it gives rise to important muscles. A study of embryology introduces us to difficulties, as well as supports, for the theory of animal ancestry. If man has come up from an ape-like ancestor, by the Law of Recapitulation the human embryo will show a projecting muzzle, a low receding forehead, a small brain, and a thumb-like great toe. As a matter of fact, it shows nothing of the sort; indeed, the fœtal ape is more like a man than the human fœtus is like an ape. Sir A. Keith [27] wrote: "Now the appearances of the embryo at all ages are known, the general feeling is one of disappointment; the human embryo at no stage is anthropoid in appearance." Either, then, the Law of Recapitulation cannot be trusted, or man did not rise from an ape. The surgery of deformities lends no support to the theory of descent from ape or monkey. One would expect that there would be frequent "throw-backs," recalling the characters of an ancestor. What are the common congenital defects? Hare-lip, cleft palate, webbed fingers, club-foot, six toes, ectopia vesicæ, spina bifida—yet none of these are characteristic of apes. We never see the aforesaid projecting muzzle, the thumb-like great toe, nor the huge canine teeth, nor the absence of chin. A universal shaggy coat of hair seldom or never occurs, except perhaps amongst the Ainu people. Berg [28] remarks: "The presence of branchial arches in the embryo of man is no proof that man in his phylogenetic development has at some time passed through the stages of a fish; it simply shows that, in mammals, in certain conditions of embryonic development, an organ resembling the branchial arches of the lower vertebrates *must* be found."

Evidence from the discoveries of fossil man is hard to interpret. The only form deviating widely from the modern type which is

well known from fairly abundant and complete bony remains is Neanderthal man, and certainly the stooping gait and huge eyebrow ridges gave colour to the notion that here was a genuine missing-link. But in some respects, *e.g.* the teeth, Neanderthal man is too specialized to be anything of the sort; he had a full-sized brain, made stone tools, used fire, and buried his dead. The other remains (*Pithecanthropus erectus*, *Eoanthropus dawsoni*, Heidelberg and Rhodesian man, etc.) are too fragmentary for dogmatism. It is by no means certain that the cranium, the teeth, and the femur (found fifteen yards away), that go to make up Pithecanthropus, all come from the same animal. It is quite probable that the femur is human, and the skull that of a large extinct gibbon. There is another difficulty, that specimens of a modern type of skull have been described (*e.g.* Galley Hill, Calaveras, Castenodolo), as old as, or even older than, these so-called missing-links, which cannot therefore be their ancestors. But the subject is far too big to be discussed at all adequately just now.

Even if we were convinced that man's body were derived from the apes, there remains his mind. To quote Professor McDougall [29]: "It is now widely recognized that the strict neo-Darwinian theory of organic evolution is inadequate. This theory ignores mind or purposive activity as a possible agent of evolution. . . . It finds itself at the conclusion of its attempt with mind upon its hands as an enormous remainder or surd that cannot intelligibly be brought into the scheme, or ignored, save at the cost of the absurdity of the whole scheme." It has been maintained by some that the gradual evolution of man's brain is proved by the increasing skill displayed in the manufacture of stone implements, first rude eoliths, then better and better chipped flints, then polished stone, then metals. This argument is very precarious. It makes the improver always more intelligent than the originator. On the same principle, the designer of a modern locomotive like the "King George V" has a much finer brain than Stephenson, because his engine is a great improvement on the "Rocket"—a very dubious proposition. The Christian, of course, believes that what principally distinguishes man from the beasts is the possession of an immortal soul, but that is, perhaps, not sufficiently tangible to advance in evidence.

The theory of descent from an ape-like ancestor has received some rude shocks of late. Professor Osborn [30], perhaps the

world's greatest authority on fossil skeletons, speaking last year in Philadelphia, said Haeckel was to blame for ignoring "the profound cleft between the ape and the man. It is our recent studies of the behaviourism of the anthropoid apes as contrasted with the behaviourism of the progenitors of man which compel us to separate the entire ape-stock very widely from the human-stock." The ape-human ancestry theory was, he asserted, greatly weakened by recent evidences, and he was inclined to advocate "an independent line of the dawn-man, whose ancestors sprang from an Oligocene neutral stock." He added that the ape-stock is "totally disconnected with the human family from its earliest infancy." Tilney, at the conclusion of his monumental work on *The Brain from Ape to Man*, published in 1928, says that "apes are quite as unconcerned in the origin of man as they are innocent of participation in it."

Conclusion.

Now, finally, how may the tentative conclusions of the biologists whose names we have mentioned lessen the difficulty of reconciling science and the Bible?

First, and mostly, by showing that, instead of crying with Darwin, "All's Chance," we must recognize that "All's Law." And Law demands a Law-giver. Since the marvellous adaptations found in Nature cannot be due to Chance, they must be due to Purpose. The theoretical systems will not work without a Creator, who foresaw His ends from the beginning, and steadily worked towards them. The common occurrence of Convergence is no surprise to the Christian biologist. Just as a skilful sculptor may reproduce a successful model in clay, in marble, or in bronze, so a wise Creator may ordain processes of development in the world of life that repeat a successful type. Colour and scent may have arisen in flowers to improve their powers of attracting insects, but that still leaves abundant room for Christ's saying, "If *God* so clothe the grass (*i.e.* the flowers) of the field." "For thy pleasure they are and were created."

Again, there may be a reasonable and fair interpretation of the first chapter of Genesis, which does not indeed solve every difficulty, but brings it quite close to the conception of the origin of living things held by, shall we say, an important minority of eminent biologists. If (in spite of the difficulty that one cannot

give a very convincing explanation of the phrase "the evening and the morning were the . . . day") these "days" are understood to mean prolonged periods of time, there is certainly a remarkable correspondence between the order of events in the record of the rocks and in Genesis. Geology would not deny that the earth might at first have been all under water; then light diffused through a cloudy atmosphere; then the dry land appeared; then vegetable life; then the sun and moon broke through the clouds and became visible from the earth's surface. It used to be thought that the older plants were spore-bearing, but modern research shows that Genesis was right in putting the seed-bearing plants very early. Genesis does not mention animals of humbler type than fish, but it is interesting to observe that Trilobites, which appear in the earliest rocks, before the "fourth day," have either very large eyes or none at all, like modern deep-sea fish that live in a very dim light. Fish appear in the Silurian (Ordovician ?) age, and the great sea monsters of Gen. i may well refer to the Labyrinthodonts (amphibians) of Carboniferous times. A difficulty has been found in that "fowl" appear too early in Genesis: in Palæontology birds come in rather late, after mammals, in the Jurassic, but this difficulty disappears when we learn from Lev. xi, 20, that עוֹף (*'oph*), the word translated "fowl," includes insects, which have been found fossil in the Silurian and Carboniferous. Land animals and mammals come next, and finally man. It is true that the biologists whose utterances we have been quoting all believe that one species may in past geological times have been transformed into another, whether by a gradual process or by "leaps," in obedience to some mysterious law, and it has been held that this is inconsistent with the phrase in Genesis "after his kind," which has been interpreted to mean that every one of our known species of animals (about 790,000) was created out of nothing, separately. But the same phrase occurs repeatedly in Lev. xi, where the true significance appears to be "in all their varieties." The Hebrew is לְמִינֵהוּ (*l^emînehû*), literally, "according to its likeness."

We are very conscious, that in attempting here to narrow the gap between the teachings of Biology and of the Bible, some difficulties have been left unsolved. We do not believe that at the present time the data exist for solving them. Nor need that surprise us. Every natural science is edged with mysteries,

and facts are known that seem to clash. It is one of the intellectual comforts of the Christian's position, that he can believe that there does exist an absolute standard of Truth, and that in the latter day, perhaps in this life, perhaps beyond, he shall understand. In the meantime, we welcome every research that throws light on God's handiwork, not greatly cast down even if for the moment it does not fit in with some cherished opinion, for, in the words prefixed by Lord Rayleigh, late President of the Royal Society, to his Collected Papers,

> "The works of the Lord are great,
> Sought out of all them that have pleasure therein."

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GEOLOGICAL TABLE OF FIRST APPEARANCES OF LIFE.

Pleistocene	(Ice Age)	Man.
Tertiary	Pliocene	Living species of mammals.
	Miocene	„ genera „
	Oligocene	„ families „
	Eocene	„ orders „
	Paleocene	—
Mesozoic	Cretaceous	Flowering plants (Angiosperms).
	Jurassic	Birds.
	Triassic	Mammals.
Palæozoic	Permian	—
	Carboniferous	Giant Amphibia (Labyrinthodonts).
	Devonian	—
	Silurian	Land plants; insects; fish.
	Ordovician	Fishlike vertebrates (Ostracoderms).
	Cambrian	Trilobites; Brachiopods; Seaweeds.
Archæozoic	—	Invertebrates; Seaweeds (?).
Eozoic	—	—

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[1] Introduction to *Nomogenesis*, p. vii.
[2] Scott, p. 10.
[3] *Nature*, 1914, pp. 635–42.
[4] Quoted by MacBride, *v. sup.*
[5] Scott, p. 12.
[6] *Theory of Evolution*, 1904.
[7] MacBride, *v. sup.*
[8] *Ibid.*
[9] Berg, p. 145.
[10] Scott, p. 22.
[11] Scott, p. 41.
[12] Quoted by Berg, p. 384.
[13] Osborn, p. 276.
[14] Scott, p. 30.
[15] Garstang, *Journal Linnæan Society*, September, 1922.

[16] Bower, p. 166.
[17] Kellogg, *Darwinism To-day*, pp. 18, 21.
[18] Bergson, *L'évolution creatrice*, 1910.
[19] Berg, p. 174.
[20] Osborn, *The Origin and Evolution of Life.*
[21] Scott, p. 57.
[22] Seward. Hooker Lecture, 1922. *Journal of Linnæan Society*, xlvi.
[23] Scott, p. 215.
[24] Bowers, p. 167.
[25] Introduction to *Nomogenesis*, p. ix.
[26] Osborn, p. xv.
[27] Keith, *The Human Body*, 1912, pp. 95, 107.
[28] Berg, p. 132.
[29] MacDougall, p. 352.
[30] Osborn, *The Times*, May 3rd, 1927.

Discussion.

Sir Ambrose Fleming (President) said: I am confident I am expressing the feeling in the minds of all present in saying that we are greatly indebted to Dr. Rendle Short for the paper he has just read to us. Not only has he given us strong arguments against the validity of the Darwinian theory of the Origin of Species, but he has framed them with copious knowledge of detail and with keen insight into the erroneous deductions which some of Darwin's followers have made from the facts of biology.

Darwin's theory professes to give an explanation of the great variety of animal and vegetable species at present existing on our globe. Darwin himself does not appear to have considered that his theory dispensed entirely with Creative Power, for in the last paragraph of his book *The Origin of Species*, at any rate in the early edition published in 1859, he uses words to the effect that there is a grandeur in the view that from certain primal types into which the Creator breathed life at first, the processes he (Darwin) described had multiplied them into endless beautiful forms.

Darwin's followers have, however, aimed at making the whole process of the production of animal and vegetable species auto-

matic from beginning to end, so as to shut out altogether the need for a supreme Intelligence and Creative Power. The self-acting machinery, whether included under the terms Natural Selection, the Survival of the Fittest, the Struggle for Existence, or Sexual Selection, was before long postulated to include the human race, and to cover mind as well as body. Hence human intelligence was regarded merely as an improved kind of animal intelligence. Then a further step was taken in the denial of mind or spirit as a separate entity from body; and mental operations, now commonly called "behaviourism," were regarded as merely the brain in operation. Finally, Darwinians in some instances arrived at the position, taken up lately by Sir Arthur Keith, that nothing in the human being survives the death or destruction of the brain.

That duality which long-established philosophies had recognized between Matter and Mind was declared not to exist, but the statement substituted for it that living matter was "purposive" and can "plan as well as execute," and that material substance naturally possesses qualities which we call mental. In brief, the order we find in the Universe was held to be, either the creation of our own thoughts, or else to have been self-produced. The final outcome of this teaching is disastrous. It reduces much of the Bible to a mere record of folk-lore, myth, or fable, or embroidered narrative, and its special teaching on the origin, destiny, and future existence of human beings is replaced by the simple inculcation of morality or philanthropy. This evolutionary philosophy is now taken for granted in much popular writing—and even in many of the pulpits of our places of worship—as so completely demonstrated that any one who disputes it is regarded by its ardent advocates as deplorably ignorant. Nevertheless, there are an increasing number of investigators, some of the first rank, who regard it as an incompletely proven or even false theory, not sufficient to cover all the facts of observation.

Even in sciences more exact than Biology, we are from time to time compelled to abandon or alter accepted theories. Thirty to forty years ago all physicists thought we knew exactly the nature of a ray of light, *viz.* that it was a transverse vibration in a space-filling ether. Now more complete research has made it clear that there are many facts which cannot be explained at all by a wave theory of light, but only by some form of corpuscular theory. The most acute minds are at present searching for a theory of light which

will cover all the facts of optics and electricity. In the same way, Einstein has compelled us to reconsider old-established ideas of space, time, force, and gravitation, and to remodel them.

Any theory of natural phenomena which is neat, simple, and easily understood is very unlikely to be the whole truth, or even part of the truth on the matter, because neatness and simplicity are not the primal qualities of this Universe. Darwin took for granted that small differences in the progeny of living organisms could be accumulated into large differences by the advantage these small differences bestow in the struggle for existence. But it is only the large differences which give any real advantage in life, and the small differences are therefore ineffective for the end or result claimed for them. The result of much searching criticism of Darwin's theory has been to show that the foundations of it are not strong enough to bear the weight of the evolutionary superstructure erected on them. Dr. Rendle Short has shown us clearly that we are yet very far from having solved the mystery of the production of species in the animal and vegetable kingdoms, by any processes which do not demand a Personal Creator to make them workable.

It is extremely valuable to have at command a record of carefully collected information, such as that which Dr. Rendle Short has given us, information that will assist readers without special knowledge of recent biological research to see that evidence for Darwin's hypotheses is not so complete as to compel submission to its conclusions, even in spite of the confident assertions of some of its advocates. This especially applies to its extension to the human race. The few and fragmentary remains of anthropoid skeletons, so far found, are not sufficient, in the opinion of some eminent zoologists, such as Professor J. Graham Kerr, Regius Professor of Zoology in the University of Glasgow, to form a firm bridge on which we can pass backward from modern man to some ape-like ancestor, as assumed by Darwinians.

I have in another place drawn attention to the way in which awkward gaps are filled up by the use of the word "acquired." If the existing Universe is not a self-produced entity, but is the outcome of the Creative Power of a Supreme Intelligence, it is in a very high degree probable, as the Bible states, that there have been many creative acts or points of new departure at intervals of time.

No one has yet been able to give the slightest suggestions as to the spontaneous origin of Matter, Energy, Life, and Mind. Careful analysis of mental phenomena indicate that Mind is something more than the operations of material brain.

If, then, the thinking, emotional, and creative abilities of man point to something other than mere matter in his composition, we have to find a beginning for this, and we have nothing to point out a sufficient cause other than a creative act of God, who formed man of the dust of the earth, that is, gave him a material body formed of the same elements which occur in the earth, but breathed into him the breath of life, imparting to him an immaterial constituent, or spirit, by which he became "a living soul."

I will ask you, then, to adopt the vote of thanks which I have now the pleasure of proposing for the suggestive and valuable paper given to us this afternoon by Dr. Rendle Short, and to signify your agreement if you think fit by your applause.

Mr. W. E. Leslie congratulated the Institute on the very valuable lecture to which they had listened, and expressed an earnest hope that it would be given a widespread circulation.

Mr. Avary H. Forbes said: I heartily endorse Sir Ambrose, and submit that this is one of the best papers we have ever had.

I am myself no scientist, though why physics should be allowed to monopolize that term I fail to see. Psychology and ethics are equally branches of science—a fact clearly recognized by Dr. Short in his paper, when he quotes Professor McDougall as saying that the Darwinian theory "ignores mind or purposive activity as a possible agent of evolution."

The evolution of man's moral nature is surely by far the most important part of the whole problem: whereas, the biologists have ignored that subject, and almost confined their attention to bones, and skulls, and fossils. I say man's *moral* nature, rather than his intellectual: because, while there is no question that man's intellect far excels that of other animals, that is a blessing or a curse solely as it is governed by his moral nature.

The possession of vast mental power without moral restraint is the most fearful danger that can be imagined. It is the character

of Satan in Milton's *Paradise Lost*. It is the character of the devil, by whomsoever conceived. Macaulay, in his essay on Warren Hastings, refers to the "most frightful of all spectacles—the strength of civilization without its mercy." Yet that is the prospect that Evolution sets before us! For no candid person familiar with history will dare to say that man's intellectual development spells moral progress. The history of savages—could it be written—would no doubt be full of cruelties. But the history of civilized pagan nations is worse, teeming as it does with human sacrifice, infanticide, and wholesale slaughter. With the development of "civilization" these cruelties grow worse! The persecution and tortures of the Inquisition far exceeded the cruelties of which paganism had been guilty.

Since the invention of gunpowder, Science has been devising methods of taking life in much more deadly ways, and on a more colossal scale. The record in atrocities was reached in the Great War, when the most scientific nation in the world invented and used a poison-gas which doomed to death, with sufferings awful to witness, thousands of unwounded soldiers; while those who survived have been afflicted for life. That, however, was not the climax; for since then far more deadly poisons, and pathogenic germs by the billion, have been cultivated, capable of wiping out the population of the largest city in the world in a few hours! And so we are threatened with a time, when—as Lord Grey of Fallodon put it—"the resources of science end by destroying the humanity they were meant to serve."

Most aptly does Dr. Short cite Professor McDougall further, saying, that evolution "finds itself, at the conclusion of its attempt, with *mind* upon its hands as an enormous remainder or surd that cannot intelligibly be brought into the scheme, or ignored, save at the cost of the absurdity of the whole scheme." The convinced evolutionist ought to be the most horrified pessimist in the world; for the logical outcome of Evolution is the production of an almighty devil!

Mr. PERCY O. RUOFF said: It has been a charming experience to have listened to this learned and informing lecture by Dr. Short, delivered without reference to the manuscript, and thus giving considerable instructive variation beyond the text of the printed

lecture. It is also an intellectual achievement upon which the lecturer may be congratulated.

It will be within the recollection of members that Bishop Butler, in 1736, wrote that it had come to be taken for granted by many persons that Christianity was not so much a subject of inquiry—it was discovered to be fictitious, and nothing remained but to set it up as a principal subject of mirth and ridicule. There is a modern analogy to this. Certain eminent theologians have, during recent years, proclaimed with a clamant dogmatism that no educated person can believe the early chapters of Genesis to have any basis in facts. This lecture dispels such a sweeping and unreasoned statement, and clearly shows that there are substantial reasons for accepting these disputed chapters; but Dr. Short rightly advocates caution and reserve in the question of interpretation. We can certainly afford to wait for further knowledge.

It is to be hoped that the lecture will be widely circulated, as it affords many valuable arguments as a contribution to a Christian apologetic. There is an ignorant dogmatism abroad which often brings into contempt the dignity and glory of Holy Scripture, and it would be an advantage if some extremely dogmatic teachers followed the example of one man who said: "There was a day in my life when I attended the funeral of my own dogmatics."

On p. 154, the lecturer presents a forceful and vital alternative when he says, "Either, then, the Law of Recapitulation cannot be trusted, or man did not rise from an ape." This is an issue which should be faced and not evaded. One other remark may be made. It is, according to the evidence of this lecture, practically certain that Darwin would have presented a very different problem to the one in *The Origin of Species* had he possessed the facts which since his day have appeared, enumerated by Berg and others.

Written Communication.

From Col. Harry Biddulph: Nature presents to our view the works of God, and the Bible gives us the Word of God, which in many places impinges on His works. The Christian knows that there is no real discord between God's Word and His works, and that any apparent difficulty is due to misinterpretation of one or the other. It is perhaps significant that misinterpretation of the

works of God has a marked tendency to lead to infidelity, probably on account of the innate pride of the human mind, whereas misinterpretation of His Word, where it deals with His works, has no such effect.

In interpreting the Bible, Westerners are very liable to error in this point, because they have to deal with an ancient Oriental language, very poor in its grammar, but peculiarly rich in feeling and imagery: the language, too, of an Eastern people, whose mind was of the qualitative rather than the quantitative type. In the case of the older books, the consideration of the root-meaning of a word rather than a derived meaning may often be necessary, e.g. *ûph*, to fly; *cf.* our word "fly," which denotes our commonest insect, whereas the verb has most frequent reference to birds and has now been extended to men.

In the phrase, "the evening and the morning were the — day," we have to remember that a more correct translation is, "and there was evening and there was morning, *one* day," "*a* second day," etc., until "*the* sixth" and "*the* seventh day." The use of "one" instead of "first" implies that this day was not the beginning of time, and the subsequent use of the indefinite article for the second, third, fourth, and fifth days is also significant. The definite article in the case of the sixth and seventh days appears to be due to the important occurrences on those days. Another implication from this repeated phrase undoubtedly is that Creation was a series of ordered steps and sustained progress, like that from fading twilight to increasing dawn: while from it must have arisen the Oriental method of calculating days from sunset to sunset.

Further, in interpreting this most ancient record, we have to remember the definition of the word "day," which it contains, for we read in Gen. i, 5, "God called the light day." Fully and correctly to interpret the phrase we lack as yet sufficient knowledge or comprehension, but one thing is clear, it was never intended by the writer to mean successive rotations of the earth on its axis.