

paraplegia. There was fearful sloughing of the integuments over the sacral region and hips. The trochanters at each side, and the osseous structure of the sacrum, were laid as bare as if they had been dissected, yet in the midst of this frightful destruction of parts, with this process of death going on in the living body, the patient seemed not to suffer any acute pain, and appeared perfectly unconscious of his terrible condition. All power being lost over the bowels and bladder, the fæces passed involuntarily and insensibly; an insufferable odor pervaded the atmosphere around him; the left upper extremity was completely paralyzed, the right was partially so; and altogether I have seldom witnessed a more distressing case. The man died on the 12th of February.

There was considerable difficulty experienced in obtaining a *post-mortem* examination, and, therefore, the state of the brain was not ascertained.

On laying open the vertebral canal, the "*theca vertebralis*" seemed healthy at the exterior, its inner surface appeared congested, and of a pinkish hue. It was only when the "*pia mater*" was slit up, that we discovered the diseased condition of the "*medulla spinalis*," and the extent to which the disorganization had reached. The diseased portion extended throughout the entire dorsal region, and was characterized by a sort of inflammatory *ramollissement*, reducing the ordinary firm texture of the medulla to the consistence and similitude of whipped cream, inflammatory action having tinged it of a red color. But the most striking pathological phenomenon presented in the diseased parts, was a tumor of about the size of a small kidney bean, and oblong in shape, embedded in the substance of the "*medulla oblongata*." When carefully examined it felt hard and firm to the touch, and *it cut like a piece of cartilage*. It was embedded in the left lateral half of the *medulla oblongata*. It seems strange that so dense a tumor could have grown in a portion of the nervous system so directly essential to life—a part in which the slightest hæmorrhage causes immediately fatal results, and in which the slightest injury is mortal. The slow and gradual development of the tumor would, perhaps, account for this. We must, I think, believe, that the existence and growth of this tumor was the cause of the *ramollissement*; but if so, was it not strange that the softening of the spinal marrow began from below and extended upwards, thus producing the long protracted series of morbid results which terminated in the death of the patient.?

Doctor Mayne exhibited the preparation of the medulla, and the diseased growth; also a drawing of the parts taken by Mr. Connolly whilst they were in a recent state, showing the altered structure of the "*medulla*," with the tumor *in situ* imbedded therein.

Zoological Lectures.

ON "OMNE VIVUM AB OVO," OR, THE NATURAL EVOLUTION OF ORGANIC SPECIES CONSIDERED.

BY W. H. HARVEY, M.D., T.C.D.,

PROFESSOR OF BOTANY TO THE UNIVERSITY.

There is, perhaps, no principle in natural history more universally admitted than the well-known axiom—*omne vivum ab ovo*. That is to say, every living thing, whether plant or animal, has been developed from a germ or egg, which germ or egg was formed in the body of a previously existing plant or animal. All human experience witnesses to the truth of this axiom. No instance is known of plant or animal which was not developed from germ or ovum. Hence, when we meet with ambiguous cases, as when plants suddenly spring up under unexpected circumstances, we never refer such appearances to spontaneous generation, but we take for granted that *seeds* of the plants in question had been concealed in the ground. Thus, it has been commonly remarked that white clover very often springs up where ground has been burned; and that, in America, when a pine forest is cut down, the new natural growth on the cleared land will not be of pines, but of hard-wood trees, a mixed forest of oak, hickory, elm, birch, &c. Now no naturalist supposes, in cases like these, that the white-clover is a *spontaneous* production of burnt soil, or that the hard-wood trees *spontaneously* alternate with the pines; but he is assured that seeds of clover and seeds of hard-wood trees had existed abundantly in the respective soils, but had long lain dormant, alive but not germinating, until *favorable circumstances*—the burning and the clearing—had caused them to sprout and grow. So also of plants that are first noticed in a district where land is turned up for railway cuttings; they are not *new* plants, but are the produce of seeds which had been too deeply buried for previous germination. Thus, in all such cases, the axiom, *omne vivum ab ovo*, is considered to hold good.

Now this axiom, which is true in all cases of ordinary experience, may safely be extended historically backward, as far, at least, as human history extends. We have no reason for supposing that, so long as man has been on the earth, any 'spontaneous' generation of animal or plant has taken place. It is true that, in ancient and modern times, the notion of spontaneous generation has had its advocates among scientific men, and, perhaps, has always had some favor in popular belief. Even at the last meeting of the British Association, Professor Daubeny brought forward an experiment which seemed to establish the natural or spontaneous production of organic cells or threads from purely inorganic elements.

But when strictly investigated, it was found that the isolated bottles in which the experiment was conducted had been stopped with *cork*,—an organic substance—and thus the isolation was shown to be incomplete. For it was argued that cryptogamic spores *might* have been present on the cork, and *might* have developed into the elementary vegetables, which alone had grown in the bottles. Now, if this be held sufficient to explain such a case of supposed 'spontaneous generation,' all other cases on record may be disposed of in a similar way. For there is no spot in nature so isolated that cryptogamic germs may not reach it, or where some minute insect or worm may not lay its egg. And cryptogamic plants, fungi, and algæ, do spring up in such abundance in all moist places, and on all decaying vegetable or animal matter, that earth, and air, and water, must be supposed to be well stocked with their invisible germs, if, in every case, our maxim, *omne vivum ab ovo*, holds good.

Now we have no valid reason for supposing that it does *not* hold good, because we find that in all properly tested cases it does hold good. On this matter, I suppose the experiments of Spalanzani are conclusive. Nor do I think that the famous suppositious production of plant-lice (*acari*) by Mr. Cross, through the agency of electricity and hydrochloric acid, or the development of the yeast fungus during the process of fermentation, are experiments sufficiently complete to allow our building upon them any hypothesis *contradictory* to the teaching of the carefully conducted experiments of Spalanzani, or to our common experience of the necessity for *parents*, in all cases of *natural* birth or development.

As far, then, as experience goes, we accept the maxim, *omne vivum ab ovo*,—'like produces like.' But it is obvious that though the maxim holds good throughout the *historic* period, and though it may safely be held, in theory, to have prevailed throughout a long *pre-historic* period, it cannot be made to hold good for an *indefinite* period. It is, after all, only *relatively*, not *absolutely* true. If we believe that every living thing, and likewise every thing that has ever lived since man came on the earth, has had parents—that *like* has constantly produced *like*—we must also believe, either that this genealogy had once a *beginning*, or believe that the procession of plants and animals has been *from* eternity, and will be *to* eternity. In other words, that 'organic life' is merely like heat and cold, light and darkness, solidity and fluidity, a binary constant of the Cosmos.

Those who, with me, do not believe this latter alternative, must needs accept the former, namely, that the first formed plants, the first formed animals—however brought into being—were not developed from eggs or germs naturally, but were brought forth *supernaturally*, that is to say, by

some creative process which man longs to look into, to comprehend, and to explain; but which, from the days of Adam to those of Darwin, he has found to be incomprehensible and inexplicable.

There is a great, and as it seems to me, a growing disinclination among the scientific inquirers of our day to believe in *special* creative acts, such as our forefathers believed in, and this disinclination gradually leads the mind, step by step, to question and then to reject the great doctrine of a personal Creator. The Creator then comes to be regarded not so much as a *Being*, with whom man can hold communion, and to whom man looks up as to a living Father; but simply as a universal and omnipotent *law*, under which man and all things else have been *naturally*, that is *necessarily* developed. This *development* is further supposed to be still going on, and that it *will* go on, of very necessity, widening and deepening for ever and for ever.

There may, indeed, be, as has been said, "grandeur in this view of life;" but is there *truth*? This is a question which ought narrowly to be inquired into before the mind embraces such glittering promises, which may, after all, be only day dreams. If we look back on man's history, so far as historians and antiquaries can carry us, I think we shall find very little *evidence* of any *uniform* intellectual progress upward, from a deeply savage and semi-brutal origin of mankind to the refinements of modern society, and the subtleties of modern thought; but *much evidence* of *one* common human nature, one and the same from the beginning, rising and falling perpetually throughout the ages; rising as high, and falling as low, in man's early history as it has risen and fallen in man's latest. Civilized man does, indeed, continually *progress* in knowledge; and age after age, as it rolls by, adds its new conquests to science and to civilization. What I mean to affirm is, that the *instrument* by which man *discovers* and by which he *applies* the discoveries of other men, namely, the intellect, may not be individually sharper and more complete now than it was a thousand ages ago. Those who deem that man's *intellectual powers* continually grow wider, and deeper, and stronger, and more godlike, as the store of his *knowledge* increases, must produce (ere I accept their authority) modern *philosophers*, physical and metaphysical, with intellects broader and more comprehensive than were the intellectual powers of Plato and of Aristotle. We look in vain for any such. Indeed, with all our accumulated advantages, we seem but as dwarfs beside these giants of the olden time.

But to return; accepting as we do the axiom, *omne vivum ab ovo*, we are constrained to start from *originally created* animals or plants *super-naturally* brought forth, from which all subsequent animals or plants have been *naturally* derived. And now I come in contact with the Darwinian hypothesis.

Mr. Darwin, in common with all Linnæan naturalists, believes in the *omne vivum ab ovo*. He also believes that 'like produces like,' under similar circumstances. Moreover he holds what some of his disciples and imitators do not hold, that, at the beginning of the organic creation, life was 'breathed by the Creator' (these are his words) into the first-formed organism; therefore, I think I am entitled to say that Mr. Darwin holds, as I do, the *supernatural* origin of the organic world. The 'breathing life' into a previously formed organism by the 'creator' implies the recognition of a *personal* work of creation very different from what other speculators would have us believe, who tell us that life is the natural result of purely physical laws; a hypothesis which necessarily leads to a belief in *spontaneous generation*.

Now the acknowledgment, by Darwin, of a *primordial form* into which life was first breathed by the Creator, has been held to be a weak point in his theory, as if, having gone so far as he has done in attempting to derive *naturally* the whole organic world from one procreant germ, he ought *consistently* to have gone a step further, to have given up the *special act* of creation, and to have regarded organic life as merely a phase of the cosmos, altogether dependent for its origin, its development, and its continuance on 'laws acting around us.' Instead, however, of thinking this acknowledgment a *weak admission* on Mr. Darwin's part, I think it a *strong position*, from which I trust he will never suffer himself to be driven; for, so long as he maintains his ideal 'primordial form' to be necessary to his theory, no man can justly charge that theory with materialism or atheism. For a *primordial* created form necessitates a *supernatural* origin of life on the globe—and everything else in his theory—every natural change—every natural development—the natural growth of every instinct, all those hard sayings which in detail constitute to most minds the objections to his book, all may be defended by the words of Bishop Butler, which he has adopted as one of his mottoes, namely, "what is natural requires and presupposes an intelligent agent to render it so."

Darwin and Linnæus, as we have seen, start from common admissions—the supernatural production of the first living thing, and that like produces like under similar circumstances; you may, therefore, fairly ask me how has the Darwinian philosophy come, at the end, to differ so widely from the Linnæan? Herein lies the difference. Linnæus and his followers hold that every *true species* (as distinguished from 'variety') if we knew its history from the beginning, could be traced back to an original individual plant or animal, which, like Adam, had been *created* from dust by the personal act of a personal creator. Therefore, as there are said to be now some 300,000 *distinct*

species of plants and animals, and as palæontology reveals to us (fragmentary as the fossil record undoubtedly is) many, many thousands more; and as it is found, on tracing back the lines of life through deeper and deeper mineral beds, that species have been changing throughout *all* time, it follows, on Linnæan principles, that there must have been not only *many* eras of creation, but that the individual interferences of *miraculous* power must have been as countless as the grains of sand on the sea shore. Now the mind, however well disposed to believe in miraculous agency, shrinks from the contemplation of *special miracles* on such a wholesale scale as this would be, and can only be driven into the belief in the absence of an intelligible theory of natural evolution. We do not conceive of the very stars of heaven that each was *separately* created; and, indeed, they so hang together in systems of mutual dependence and balance, as almost to compel a contrary belief. And is there no similar connexion of dependence and balance among organic species? The systematist, who studies affinities; the comparative anatomist, who studies the relations and modifications of organs and parts; the morphologist and the embryologist, who study development, will all bear witness to the close connection and mutual dependence of organic species. And ought not such connection and dependence to teach us that they were not all *separately* created?

At first view, indeed, it seems comparatively easy to admit any number of separate acts of creation required. But the more closely the *Linnæan* hypothesis is examined, the greater are the difficulties it presents, until it becomes not merely difficult, but impossible to admit all the inferences which naturally arise from pushing it to an extreme. And yet, as I think, we are not to reject a hypothesis of *separate* creative acts. I see no cause to question the *original creation* of many distinct animal and vegetable types; but how many, and how unlike modern animals and vegetables I cannot guess. But I do question the consequences that follow a stringent reception of the Linnæan hypothesis of the *separate* creation of every existing and fossil species.

Now, in opposition to Linnæus, Mr. Darwin is ultimately driven, partly by evidence, partly and largely by analogy, to infer "that probably all the organic beings which have ever lived on this earth have descended from some one primordial form, into which life was first breathed by the Creator." On this view, therefore, all plants and animals that now exist, or that have ever lived, have sprung *naturally*, that is, *ab ovo*, from their single primordial progenitor. This is Darwinism in its broadest statement, and the modes by which the past and present organic beings are believed to have been *naturally developed* from a primordial, will be found ably set forth in that remarkable work,

"*The Origin of Species through Natural Selection.*" By 'natural selection,' Mr. Darwin means the natural preservation and perpetuation of improved varieties of continually varying races, and the occasional dying out of unimproved or weaker races; hence, the constantly recurring changes in organic form and function, whenever changed circumstances originate new instincts or new modifications of structure, or cause the obliteration of the old. The progress of nature in this view, is the stream of time, forgetting what is past, and ever devising for the future. From *natural selection*, on Mr. Darwin's hypothesis, all species, races, and varieties whatsoever have been derived; but from the Creator has come that *ideal* primordial which served as the starting point for natural divarication.

In brief—Linnæus may be said to treat *all species* (so called) as if they were parallel lines, as distinct at their origin as they are equidistant throughout their course;—Darwin treats species as quasi-parallel but slightly diverging lines, one in their origin—branching as they diverge and never again uniting (save by occasional hybridity) after they have once divaricated.

Now let us inquire what probability there is for Darwin's belief in the divarication and multiplication of species;—what reasons for attributing to one common progenitor all plants and animals, however diversified.

In the earlier chapters of his book, Mr. Darwin dwells at large on the impossibility of distinguishing variety from race and species; on the tendency of all forms to vary, and the fact that peculiarities of form, once introduced, are probably perpetuated through an indefinite number of *slightly varying* generations; on the extraordinary modifications of form and function which have arisen, under man's care, among domesticated animals and plants; and on the continual tendency of the strong to exterminate the weak, in the 'struggle for life.' But admitting all that has been urged on these topics, and allowing for all the additional evidence which Mr. Darwin has reserved, and for all that other evidence which naturalists, working independently, are now busily collecting everywhere,—we have gone but a little way indeed on the long journey toward a "primordial form." It appears to me that we have got no further than to the breaking up of our old *notions* as to the possible limits of varieties and species; and to the recognition of a *modifying agent* in nature, capable of effecting organic changes through successive variations, very slowly accumulating or perhaps only fluctuating from generation to generation. The *recognition* of such a principle is indeed no mean step in science;—but we have yet to learn, from *nature*, and not from

hypothesis, to what extent such organic changes are *possible*. Mr. Darwin indeed believes that such variability is infinite: hence he is necessarily driven back to his 'primordial form,' the common progenitor of *all* organic beings. But those who, with me, still venture to question the *unlimited* operation of natural selection—who think that natural selection, like man's selection, may have *distinct* and *defined* limits—although those limits, when compared to the limits of man's selection, may appear, to our narrow vision, both *indistinct* and *unlimited*,—we, who thus believe, may freely admit all that can justly be inferred from all the evidence collected by Darwin and others, and yet may withhold assent from his ultimate doctrine, and may question altogether his hypothesis of a 'primordial form.'

The chapters of Mr. Darwin's book which have most impressed me are not those early ones, already alluded to, but the latter chapters,—those on Geological Succession, Geographical Distribution, Mutual Affinities, Morphology and Embryology. Strong in my Linnæan armour I fought manfully through all the early chapters till I came to these; and had I then closed the book, I should probably have closed it with a high opinion of Mr. Darwin's ingenuity, but firm as before in the truth of my Linnæanism.

I cannot now enter on the many things in Darwin's latter chapters which have modified my early views, but must confine myself to one or two points connected with geological succession, and which seem to favor the hypothesis of successive modification of organic types. And this I must do without more than barely alluding to the means through which the supposed modification has been effected.

First, let us take an individual species—say, *the horse*. We are familiar with the living varieties of horses, including the *Suffolk dray horse*, the *race horse*, the *Shetland pony*, and fifty other well-known breeds and races, more or less unlike each other; but all regarded as belonging to but *one species*. Now, besides these familiar kinds, there are *fossil species* of the horse genus, which, judging from their bones, must have agreed in very many *essential* characters with the living horses, but which differed from them by what are called *specific* characters. By specific characters, I mean differences so marked that we suppose, had the fossil and the recent horses dwelt together on the same pastures, they would have herded *separately*, and no hybrid race would naturally have arisen between them. But taking into account the greatly diversified *races* of living horses—all of which have come into being during man's short tenure of civilization—is it so unreasonable to suppose, that the first horses tamed by man, and from which all known living varieties have naturally descended, may not themselves have descended naturally from

some, now fossilized parent, and that if we knew the whole genealogy we might be able to trace back that parent's descent from the earliest fossil horse created. It must be borne in mind, that probably an inconceivably vast period of time separates the fossil from the recent type; a period *possibly* sufficient to allow for the accumulation of successive variations, and to account for our specific differences. Be this as it may, viewing the case before us as it appears to stand, I think we must choose between one of two alternatives, namely, 'did all fossil horses die *completely* out leaving no progeny, and were the modern horses, then, absolutely *created* without ovum, and did a *new creation* without ovum occur every time that a new kind of horse was brought into being? Or did the race of fossil horses *not* wholly die out, and may not the survivors have perpetuated a breed of horses, which, slowly changing throughout a geological period under changing climatal conditions, in successive generations may have produced a very diverse breed of horses, and may not these, still yielding to further changes, have undergone further modifications; and, at last, may not the actual progenitors of our modern horses have been born from the *last variety* of an older race at the commencement of the existing geological era?"

All this, of course, is *hypothetical* reasoning, partly from facts, but very largely from analogy. It *may*, therefore, be wholly beside the mark, but taking both these questions dispassionately, I think the *probability* is in favor of the latter hypothesis. I think that it is more probable that the *living horse* is a lineal descendant of some *fossil horse*, than that God first *wholly destroyed* one horse and then *re-created* from the dust a slightly improved horse. Nothing that we know of in the Divine government disposes us to this latter belief. The Creator never wastes power so wantonly. Why did he preserve Noah and his family, but to keep unbroken the line of Adam's posterity? If he merely wished to purify the earth, a simpler plan would have been to have destroyed mankind altogether, and then to have created a new and sinless man and woman, and to have given to them the dominion that Adam's race had forfeited. This would have been doing what so many geologists and others *suppose* has been done *tens of thousands of times* over in the matter of animals and plants, but it would not have been doing what we know, by sacred history, has been done in respect of man.

Passing now from particular instances, let us consider what the *general* facts of palæontology teach concerning a supposed derivative descent of species from species. For, however imperfect the geological record may be, enough surely is known of the fossil faunas that have successively peopled the world, to enable us to form some broad generalizations on this subject.

In the first place, I suppose it will be granted that a *progressive improvement* in organization may be traced upwards from the lowest through the medial, and to the highest fossil-bearing strata; that the forms of life which existed in the silurian era, for instance, were, as a whole, inferior in organization to those afterwards introduced in more modern formations, and so upwards, till passing through an era of saurian giants we arrive at the first mammals; the highest development of the vertebrate type of structure. Thus the vertebrate type has clearly, as a whole, *progressed* from era to era.

In the next place, palæontologists assure us that *several* successive animal populations or 'faunas'—as many as thirty or forty—have appeared, flourished, and disappeared, since life began on the globe. Each of these thirty or forty faunas had its peculiar and characteristic or dominant species, by which its scattered provinces, in different countries, may be at once recognized. But, however distinguishable one of these faunas may be from another, there are often *some*, and sometimes *many* species that are found in more than one fossil fauna. Now this fact is of importance to our argument, for it proves that so far as these species were concerned, there was no *break* in the continuity of life, but that one, so-called, *period* of geological succession, really blended into the preceding or the succeeding periods, probably into both. But if, as has been urged, the *proofs* of this blending of period with period be few, the imperfection of the geological record may fairly be pleaded in reply. And, indeed, if but one single species be proved to have lived from one geological period to another, this would be *sufficient* evidence that the causes which destroyed other species were not so absolutely antagonistic to animal life as to *necessitate* a wholly *new creation* of animals. And I hold that nothing short of *absolute necessity* would warrant our assuming a departure from the axiom with which we started, *omne vivum ab ovo*.

Lastly, it is allowed, that if we examine in detail the whole series of the thirty or forty successive fossil faunas, comparing each with the *succeeding*, and the most recent with the *existing* fauna, we shall find, as we approach the modern epoch, that each fauna shows, in the animals whose remains are preserved, a nearer and nearer resemblance to the fauna now living. Indeed, among the lower animals, many still existing species are *identical* with fossils of the latter and middle tertiary, and some with those of still earlier eras. Here, then, we have geological evidence of some thirty or forty fossil faunas, each at its limits slightly blending with the following;—the *earliest* in time most unlike the *latest*; but each in its order more and more like that *latest*; and that latest fossil fauna itself not very dissimilar from the fauna now in being.

What do such facts teach us, if not that the *continuity* of life has never once been interrupted since life first came upon the globe? Do they not almost *compel* us to push back into the utmost depths of unrecorded time our guiding maxim, *omne vivum ab ovo*?

This, at least, is the inference which I draw from the evidence of palæontology. Without inquiring, at present, by what means diverse forms were successively brought into being, I do think we have evidence compelling our belief that the natural generations of plants and animals have gone on, *uninterruptedly*, from the earliest dawn of life to the present day.

Now, when we have once convinced ourselves of this *uninterrupted* succession of life, we have gone a long way towards a belief in an orderly or natural *evolution* of species from species. For then the known facts of geographical distribution, of the mutual affinities among organic beings, of morphology, of embryology, and of rudimentary organs, become satisfactorily explicable on a hypothesis of natural transmutation of species, and on no other hypothesis yet started.

I cannot now enter into the proofs of this assertion. I can only declare that it is the conviction at which I have arrived from a careful study of facts, in spite of the prejudices of education, and of my former firm belief in the Linnæan doctrine of the *fixity* of species—Nature's '*aphorisms*' I used to call them; Nature's '*postulates*' I call them now.

Having gone so far, you may fairly ask me whether I accept Mr. Darwin's theory of 'the *origin* of species through natural selection,' and his ultimate inference that, through the same agency alone, all species, past and present, have sprung from a single 'primordial form?' To this I answer No. I do not accept Mr. Darwin's theory as an *explanation*, but as a *suggestion*:—I do not think that 'natural selection' (as defined by him) is *alone* sufficient to account for the past and present organic creation; and, as for believing in a 'primordial form,' whose existence can never be established, it would be travelling out of the province of biology to discuss it. No real *evidence* can be adduced either for or against a primordial form;—advocates and opponents must alike draw on their imagination, and must reason (if reason they do) wholly from their individual conceptions of the analogies of Nature. The result of such reasoning on such data may serve to amuse, but can add nothing to solid science. *Facts* there are none to build upon; and *facts* are the stubborn things on which alone natural science can securely rest. Analogies, in science, however pleasing, are, if unsupported by facts, mere moonshine.

And now, as to the theory of natural selection. Why does it not *explain* the facts of organic nature? I have already admitted that, by it, many inferences in favour of transmutation, and

many of the facts of homology and embryology, may be satisfactorily harmonised;—but still, I hold it insufficient to explain the *major part* of the problem of nature, and for these reasons:—

Natural selection presupposes *variability*, but it does not explain or satisfactorily account for *variability*:—

Natural selection presupposes what is called the "*correlation of organs*," that is, it assumes a force in nature constraining every living thing to organise itself symmetrically, with mutual relation and dependence of organs, and with strict reference to outward circumstances and habits of life;—but natural selection neither explains nor accounts for the correlation of organs.

Thus I find natural selection not to be a *primary*, but a *secondary* agent in the production of species:—for it depends on *variability* and the correlation of organs. But the *cause* of *variability* is as much unexplained as are the *causes* of growth, of reproduction, and of inheritance (or the resemblance of child to parent). The *cause* of correlation of organs is equally unknown.

On two *unexplained* primary agents (primary, at least, as regards *our* argument), natural selection, therefore, depends; for without them there can be no *natural evolution* whatever, and granting these primary agents as axioms to work with, *natural evolution* may be true without *necessitating* our belief in *natural selection* at all; that is, in Mr. Darwin's infinitesimal and accumulated divergences, his all but infinite drafts on past time, on varied conditions, and the struggle for life. For a Power that is assumed to work by means of *infinite variability* and *exact adaptation of organ to function* and of *instinct to animal wants* must, indeed, work by the wand of a magician, and may be held competent to evoke the organic world by successive modifications of one primordial form; but that Power need not be *natural selection*, but *supernatural evolution*. Nothing in evidence compels us to accept Mr. Darwin's concluding words, that "*from the war of nature, from famine and death, the most exalted object which we are capable of conceiving, namely, the production of the higher animals, directly follows.*" No doubt, all these and other natural agencies work out the order of nature, but they are *indirect* (not "*direct*") in operation; they are but thunder clouds that clear the air.

Darwin's theory of natural selection, as I think, does, indeed, break up our old notions, and does lead us to believe in the evolution of species from species; but here its legitimate conclusions stop short, and leave us still to confront the *causes* of growth, reproduction, inheritance, variability, and correlation, the still unresolved residua of our problem, and, as I take it, the real body of the problem itself.

Now, whence arise these unexplained powers of organic nature? Those who think with me are

content to refer them to the direct act, and the unflinching superintendence of a Supernatural Worker who is above all, and through all, and in all the works of nature. Granting such a Being, ordering, appointing, moulding, and upholding, we may freely grant to natural selection to carry out the minor details of the Omnipotent will. But losing sight of such a Being, as some modern speculators seem to do, we are driven in the present state of our knowledge into a quagmire of paradoxes and dilemmas (which Darwin calls the *difficulties* of his theory), only to be bridged over by repeated drafts on the "imagination." The original hypothesis requires to be buoyed up continually by minor hypotheses, or by attributing to "natural selection" personal powers, such as, of right, appertain, to the Deity alone. Now, I cannot consent to put "natural selection" in the seat of Deity. Hence, though I very willingly accept Mr. Darwin's labors as those of a true pioneer in the cause of truth, I can only regard them as affording stepping-stones to a theory better, fuller, and more enduring.

I have already occupied your time sufficiently, but yet, as the question of the origin of man has been, *ad nauseam*, mixed up with my subject, I can hardly conclude without a few words respecting it. Perhaps the least said the better; for at present we have no *facts* to build a theory upon, and the voice of analogy is too weak to be heard, on so important and so *exceptional* a case.

For, notwithstanding the general conformity of man's frame to the quadrumana; notwithstanding the absolute identity of man's animal powers with those of other animals;—notwithstanding the possession of some mental power, undistinguishable from reason, in the elephant, the dog, the horse, and in other animals long subjected to man's control, and depending on him for their education;—and lastly, notwithstanding the deeply degraded state of the Australian or the Fuegian savage;—granting all this, surely man as man does stand out broadly and boldly above the whole animal creation; and is separated from it by a barrier, as deep and wide, and seemingly as impassable, as that which sunders heaven and hell. I speak to those only who believe that man's soul is a divine impress, and not merely the developed instinct of a bee, an elephant, a dog, or an ape, or the quintessence of the instincts of all collectively. I have not time or inclination to argue with those who, in this nineteenth century after Christ, think thus;—to them, if such there be, I can only quote the words of Tennyson:

"Let him, the wiser man, who springs
Hereafter, up from childhood shape
His action like the greater ape,
But I was born to other things."

And so I trust all who now hear me were 'born to other things.' The legitimate problems of Natural History are quite wide enough to employ all the energies of the present and of many succeeding generations;—nor, till they are mastered, have we any plea for looking through them, beyond them. It is only the dabblers in science, and the Quidnuncs of society, who force such questions as the origin of man on scientific men. Sober inquirers are contented, for the present, to take man as he is, and are more desirous of building him up into what he ought to be than of ferretting out his hypothetical origin. Mr. Darwin wisely refers to "the distant future" all such speculations. We may therefore suspend our guesses where our master in hypothesis has suspended his.

For my own part, holding as I do the hypothesis that it may have pleased the Creator to evolve animal species from many original progenitors, and not from "one primordial form," I do not feel called upon to speculate on any origin of the first man, Adam; or yet to settle the exact epoch at which this crowning and crowned work of Deity was placed on the earth. Let the era of man's creation engage the attention of the geologist, to whose province its determination belongs, and let us await the circumstantial evidence which he may discover. Nor shall I touch upon the question of man's supposed affinity to the gorilla, or to any other animal; let Owen and Huxley, and the comparative anatomists settle this subject as best they can. In the present state of human knowledge all such topics of inquiry must be looked on as "open questions;" or rather, as unresolved problems of Natural History.

And now, I cannot conclude better than in some well-known, but not hackneyed words of our great poet:—

"Our little systems have their day;
They have their day and cease to be;
They are but broken lights of thee,
And thou, O Lord, art more than they.

"We have but *faith*: we cannot *know*;
For knowledge is of things we see;
And yet we trust it comes from thee,
A beam in darkness: let it grow.

"Let knowledge grow from more to more,
But more of *reverence* in us dwell;
That mind and soul, according well,
May make me music as before,

"But vaster. We are fools and slight;
We mock thee when we do not fear;
But help thy foolish ones to bear;
Help thy vain worlds to bear thy light.

"Forgive these wild and wandering cries,
Confusions of a wasted youth;
Forgive them where they fail in truth,
And in thy wisdom make me wise."

TENNYSON.