AN EXPOSITION OF

FALLACIES IN THE HYPOTHESIS

OF

MR. DARWIN.

BY C. R. BREE, M.D., F.Z.S.
Charles Robert

SENIOR PHYSICIAN TO THE ESSEX AND COLCHESTER HOSPITAL:

Author of

'Species not Transmutable nor the Result of Natural Selection,'

'The Birds of Europe not observed in the British Isles,'

'Popular Illustrations of the Lower Forms of Life,'

&c.

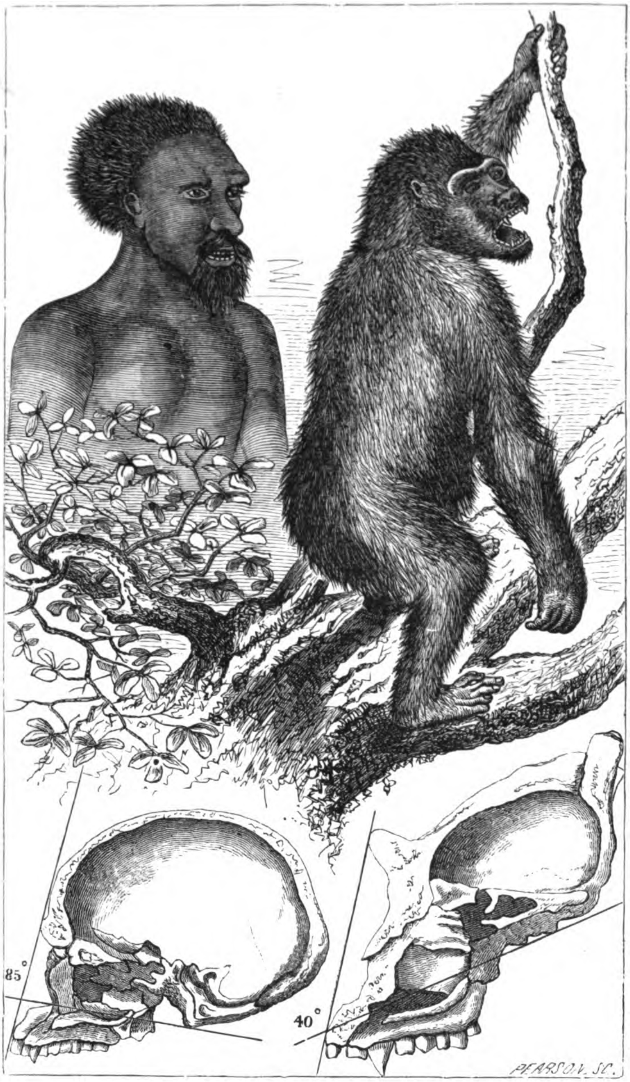
'DE OPIFICE TESTATUR OPUS.'

LONDON:

LONGMANS, GREEN, AND CO.

1872.

Fig. 15*. *Plate IV.* *Fig.* 15.



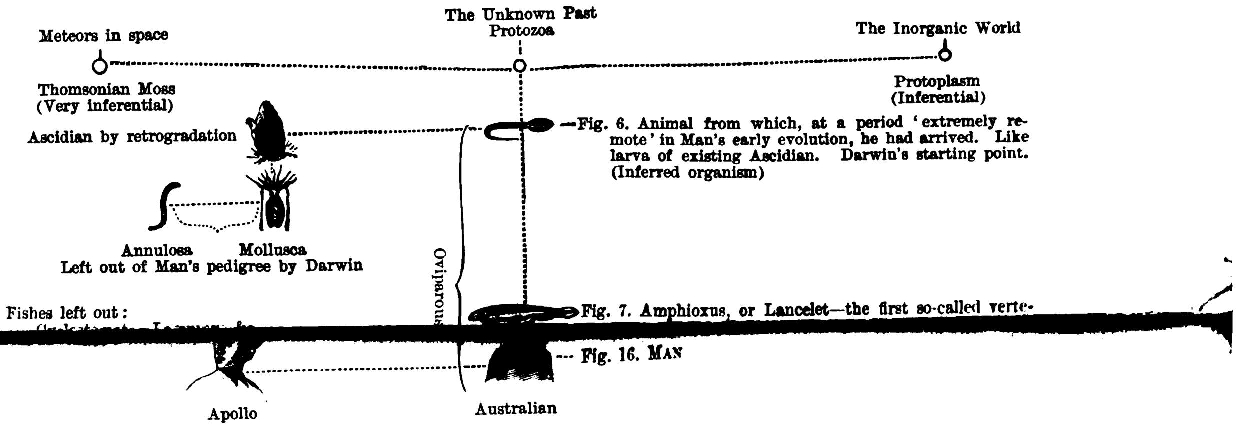
15. The Gorilla, *or Man-like Ape.*

The Animal nearest to Man in organisation; and its Skull, showing the facial angle of 40°.

15*. Australian Savage.

The lowest type of Man as to structure; and his Skull, with facial angle of 85

THE DESCENT OF MAN, AFTER DARWIN'S THEORY.



CONTENTS.

CHAPTER I.

INTRODUCTORY.

CHAPTER II.

THE PHYSICAL ARGUMENT.

Darwinism as it receives support or otherwise from the assumed correlation of the Physical and Vital Forces.

CHAPTER III.

THE PHYSICO-PSYCHICAL ARGUMENT.

CHAPTER XII.

THE VARIATION AND NATURAL SELECTION ARGUMENT CONTINUED.

CHAPTER XIII.

THE VARIATION AND NATURAL SELECTION ARGUMENT CONTINUED.

CHAPTER XIV.

THE VARIATION AND NATURAL SELECTION ARGUMENT CONTINUED.

CHAPTER XV.

THE VARIATION AND NATURAL SELECTION ARGUMENT CONTINUED.

CHAPTER XVI.

THE VARIATION AND NATURAL SELECTION ARGUMENT CONTINUED.

CHAPTER XVII.

THE VARIATION AND NATURAL SELECTION ARGUMENT CONTINUED.

CHAPTER XVIII.

THE VARIATION AND NATURAL SELECTION ARGUMENT CONTINUED.

CHAPTER XIX.

THE VARIATION AND NATURAL SELECTION ARGUMENT CONTINUED.

Mr. Darwin's Supporters.

CHAPTER XX.

THE VARIATION AND NATURAL SELECTION ARGUMENT CONTINUED.

Mr. Darwin's Supporters.

CHAPTER XXI.

THE VARIATION AND NATURAL SELECTION ARGUMENT CONTINUED.

Mr. Darwin's Supporters—Professor Huxley.

CHAPTER XXII.

THE VARIATION AND NATURAL SELECTION ARGUMENT CONCLUDED.

Mr. Darwin's Supporters.

CHAPTER XXIII.

THE DERIVATIVE DOCTRINE OF PROFESSOR OWEN.

CHAPTER XXIV.

MR. DARWIN'S LINE OF DESCENT.

CHAPTER XXV.

THE TELEOLOGICAL ARGUMENT.

CHAPTER XXVI.

THE TELEOLOGICAL ARGUMENT.

CHAPTER XXVII.

THE TELEOLOGICAL ARGUMENT CONTINUED.

CHAPTER XXVIII.

THE TELEOLOGICAL ARGUMENT CONCLUDED.

CHAPTER XXIX.

EVOLUTION AND THEOLOGY.

LIST OF ILLUSTRATIONS.

DRAWN AND ENGRAVED BY G. PEARSON.

THE

FALLACIES OF DARWINISM.

CHAPTER I.

INTRODUCTORY.

Dr. Hooker's statement as to the position of Darwinism at Norwich.—Not borne out by facts.—Agassiz.—His opinions upon Darwinism.—Other European writers.—M. Flourens.—The 'Athenæum' upon Dr. Hooker.—The *Odium Theologicum*.—The importance of the subject as affecting human thought and action.—The reviewer in the 'Edinburgh Quarterly.'—Division of the subject.

In his address as President of the British Association at Norwich, in August 1868, Dr. Hooker made some remarks upon the hypothesis of Mr. Darwin, to which, I think, exception may be fairly taken. I select the following passage: 'So far from "natural selection" being a thing of the past, it is an accepted doctrine with every philosophical naturalist, including, it will always be understood, a considerable proportion who are not prepared to assent that it accounts for all Mr. Darwin assigns to it.'

I did not then, nor do I now, three years afterwards, think that this statement could be borne out by proof. Since that address was delivered, indeed, Natural

Selection has rather gone down in the world, for Mr. Darwin himself has discovered that he had carried it too far;[1] and Mr. St. George Mivart has proved, and I think incontestably, that it has not a basis of truth.[2] But at the time of the Norwich meeting some of the most celebrated men in science were utterly opposed to the whole of Mr. Darwin's hypothesis. Notably may be mentioned Agassiz the Cuvier of America, and M. Flourens, the Secretary of the French Academy.

Dr. Hooker did not merely make the sweeping assertion above referred to, but he quoted Agassiz himself as a witness in his favour. That this was done from a misapprehension of what Agassiz said, as suggested by the 'Athenæum,' I fully believe. Dr. Hooker's words were: 'Reviews on the "Origin of Species" are still pouring in from the Continent, and Agassiz, in one of the addresses which he issued to his *collaborateurs* on their late voyage to the Amazon, directs their attention to this theory as a primary object of the expedition they were then undertaking.'

I again quote the 'Athenæum' upon the above passage: 'He said the reverse. We requote the pith of his remarks for the benefit of Dr. Hooker. M. Agassiz says: "The South American faunæ will give me the means of showing *that the transmutation theory is wholly without foundation in facts. . . . If the facts are insufficient on our side they are absolutely wanting on the other. . . .* We certainly cannot think

[1] *Descent of Man*, 1871. [2] *Genesis of Species*, 1871.

the development theory proved because a few naturalists think it plausible. . . . I wish to warn you, not against the development theory itself, but against the looseness of the methods of study upon which it is based." '[1]

Dr. Hooker, after making the statement that the Darwinian theory was 'an accepted doctrine with every philosophical naturalist,' goes on to quote Agassiz again; and, as I noticed to a clergyman sitting next to me in the Drill Hall, in a manner which would lead the great majority of his hearers to believe he was doing so as a supporter of the Darwinian hypothesis. 'Having myself been a student of moral philosophy in a northern university, I entered on my scientific career full of hopes that metaphysics would prove a useful Mentor, if not quite a science. I soon, however, found that it availed me nothing; and I long ago arrived at the conclusion so well put by Agassiz, where he says: "We trust that the time is not distant when it will be universally understood that the battle of the evidences will have to be fought on the field of physical science and not on that of the metaphysical.' "[2]

In answer to this inference, I will give some extracts from one of Agassiz' most recent works, viz., 'The Structure of Animal Life; being six lectures on

[1] *Athenæum*, Aug. 29, 1868, p. 270–1.

[2] Agassiz on the Contemplation of God in the *Kosmos*, *Christian Examiner*, Fourth Series, Vol. XV. p. 2.

the Power, Wisdom, and Goodness of God, as manifested in His works,' delivered at the Brooklyn Academy of Music in January and February, 1862, and published in London with corrections in 1866. 'The study of nature has one great object which fairly comes within the scope of the foundation of this course of lectures. It is to trace the connection between all created beings; to discover, if possible, the plan according to which they have been created, and to search out their relation to the great Author (p. 1).

'Such is the position of science. It is the questioning, the doubting element in human progress; and, when that has gone far enough, it begins the work of reconstruction in such a way as *will never harm true religion,* or cause any reasonable apprehension to the real and sincere Christian (p. 2).

'At this moment natural history can show, not only that there is a plan in the creation of the animal kingdom, but that the plan has been *preconceived,* has been laid out in the course of time, and executed with the definite object of introducing man upon earth' (p. 3).

'It is an undoubted fact that the differences among domestic animals, which we designate by the term "breeds," are of comparatively recent date. The time when many of them were first introduced is known, the variations are the work of man—the result of human care, of artificial means. *But these differences are not of the same kind as the differences we observe* *among wild animals'* (p. 50). I need not say that the latter part of this passage, printed in italics, is utterly at variance with the Darwinian hypothesis. Further:—

'Here then we have the evidence that these differences are the work of man, the result of artificial means applied for the purpose of rendering the animals subservient to him; while, on the other hand, the differences existing among wild animals are the result of a *creative power* over which the mind of man has no control. Domesticated animals show us only the amplitude of the pliability of structure in each animal, and in no way the method by which the diversity existing among wild animals can be supposed to have been introduced. Domestication never produces forms which are self-perpetuating, and is therefore *in no way an index of the process by which species are produced'* (p. 51). I quote the following to show the fairness with which Agassiz treats the subject:—

'Now the question with reference to the existence of living beings, whether they are the products or results of laws working in nature, established by the Almighty, or whether they are the work of the Creator directly—this is the point I propose to examine on the basis of scientific facts; not on the moral ground upon which we trust in Divine Providence, but upon scientific evidence, for science must deal with facts on its own ground, without reference to preconceived opinions or convictions, and we should welcome what science has to say upon the subject of an overruling Providence' (p. 91).

Upon the Darwinian hypothesis he says:—

'If we were to credit a certain theory which is very well received at this time, which has lately been propounded by some very learned, but I venture to say *rather fanciful scientific* men, it would appear that in the beginning animals were few in number, and that as they became more and more numerous they became more and more different from one another, as if all the diversity which exists on the earth at the present moment had grown out of a comparatively simple and small beginning. This is an impression which prevails so generally, that before I take another step in my demonstration, I will endeavour to show the fallacy of it' (p. 92).

Let us hear this great man upon a subject which has rendered his name immortal, as an illustration of the crushing remarks in the above paragraph: 'The number of species of fishes in the Mediterranean is only a few hundred; those that inhabit the German Ocean only about 180 or 200; those on the Atlantic coast of France not more than 250; and yet the sum total of the different kinds of fish known in all parts of the world is nearly 10,000. If we were to compare the fossil fishes found thus far in the strata of the globe, with those of the whole world as they now exist, we should make the same mistake as in estimating the inhabitants of one region as those of the whole world. The fossil fishes . . . which were found at Mount Vulcan, near Verona, are from a celebrated quarry not many miles in extent, in which over 100 different kinds of fossil fishes have been taken. The Adriatic, in its whole extent, does not furnish as many different species as are found in this quarry. I have examined the fossil fishes of the neighbourhood of Riga on the Baltic, and they are more numerous than the present living species of the Baltic and German Ocean' (p. 95).

Having given similar results with regard to shells to prove that in former periods, 'within similar areas there was as great diversity of animals as now exist,' Professor Agassiz remarks: 'What better evidence do we want that *at all times* the world has been inhabited by as great a diversity of animals as exists now and that at each period they have been different from those of every other period? This is a very important fact, because it is a *most powerful blow at that theory which would make us believe that all animals have been derived from a few original beings which have become diversified and varied in course of time.*' The italics above are mine. The statement is most explicit, and I think the reader will by this time be beginning to think that Professor Agassiz is not a believer in the Darwinian hypothesis.

Turning to writers on the subject in Europe, we find the names of Owen, Phillips, Beale, Haughton, Stirling, Wollaston, St. George Mivart, among many others in our own country, who have taken a more or less decided attitude against Darwinism.

For my present purpose, however, I take from France the name of an eminent man who has lately gone to his account, which will not pale before that of the most celebrated disciple of Darwin. I mean that of the late M. Flourens.

In the 'Athenæum' of August 29, 1868, the omission of any notice of this 'philosophical naturalist's' work, written in direct refutation of the hypothesis of Darwin, is thus alluded to :—

'Dr. Hooker has carelessly read the critique he quoted. In it Mr. Charles Darwin is accused of ignoring the work published by M. Flourens in refutation of his hypothesis. This work is founded upon the results of the experiments in crossing breeds which have continued for about one hundred years by Buffon, by George and Frederic Cuvier, and by M. Flourens. If Dr. Hooker had read the critique (upon Darwin's last two volumes on the "Variation of Plants and Animals under Domestication," February 15, 1868) attentively he would have been aware of the existence of this book; and surely the President of the British Association would have deemed some notice due to the Perpetual Secretary of the French Academy of Science, and Director of the Museum of Natural History at Paris.' I shall have occasion hereafter to allude especially to the work of M. Flourens,[1] and

[1] Appendix.

therefore I need not make any quotations here to prove that he is utterly opposed to the hypothesis of Mr. Darwin. I think the most sceptical reader will admit that Dr. Hooker had no foundation for the assertion that natural selection 'was an accepted doctrine with every philosophical naturalist.'

Every day we hear of thoughtful men expressing their dissent therefrom. When Mr. Darwin's work on the 'Origin of Species' was first published, three or four naturalists connected with him or with each other by great friendship and a community of thought came forward and threw all their influence into the scale in his favour. Smaller minds in abundance were easily brought within the magic circle. To the scientific periodical press such men contributed the materials of existence and they were gradually drawn into the net. Our societies, influenced by similar means, have had the tone of their publications gradually changed into the phraseology and teachings of an unproved hypothesis.

Professor Huxley writes a book to show that man has been evolved from the ape, and has latterly wasted much of his valuable time in writing and teaching the transformation of reptiles into birds; a hundred tongues join in the cry, and hence we find 'natural selection' and the 'evolution of species' proclaimed as bases of natural science from the Presidential chair of the British Association.

The 'Athenæum' of September 19, 1868, in reviewing Mr. Vernon Wollaston's 'Coleoptera Hesperidum,' has expressed the fact just alluded to in the following words:—'It commonly happens that on the promulgation of any theory, either absolutely new or put in a new and striking point of view, if the theory be in itself startling, and so to speak, sensational in its character, and especially if it be propounded with all the prestige belonging to one whose talents and acquirements entitle him to especial regard, it is at once seized upon and adopted by many *who, unable themselves to lead,* are vain of being led by so distinguished a general—themselves perhaps unconscious at first of the end to which he is conducting them. It is quite natural for instance, that a theory emanating from a man of Mr. Darwin's known intellectual power, his great scientific attainments, his laborious accumulation of facts, his unswerving and pure truthfulness, and the charming *bonhomie* of his temper, should have attracted a large following and produced a powerful impression on the scientific mind of the day.'

'And "by many who think themselves wise, and by some who are thought wise by others," and by not a few too, who are really wise, the theory has been cordially, even enthusiastically adopted in its fulness, and thus becomes a matter of too much importance to be gazed at as a mere scientific meteor. This is not the place nor the opportunity to enter into the controversy, *but we cannot help noticing the avidity with which every new discovery however imperfect is forced* *into the service of the supporters of his views, whilst the truths which tell irrefragably in the opposite direction, are either ignored or put unceremoniously aside.* For example, the unanswered and unanswerable difficulty of the geological phase of the subject is met with the almost contemptuous excuse that geology is as yet imperfectly known. May not this be fairly met with a *tu quoque*?'

In the year 1860 I published a small volume upon the Darwinian hypothesis, in which I endeavoured to show that it had no solid basis of truth.[1] I was accused by some adverse critics of having in that little work used the *odium theologicum* argument in opposition to scientific facts or researches. Such a charge could only have been made as an excuse for not answering inconvenient facts.

Since that time Darwinism has undoubtedly spread in a certain direction. I propose however, to take up the subject again, and to enquire in a purely scientific spirit, whether it has really made any solid advancement in the way of absolute proof, or sound logical deduction as to its truth.

Before I begin, however, let me say one word about the *odium theologicum.*

If, in a scientific discussion, a man appeals to statements in scripture in proof of his views, I believe he will lay himself open to the charge of using unfair

[1] *Species not Transmutable nor the result of Natural Selection.*—Groombridge.

weapons. The scriptures are not scientific authorities, nor ever were intended to be; therefore, they should not be quoted to support or refute scientific statements. But the question raised by theories like that of Mr. Darwin has a wider and more important significance, and it is one which no scientific man has a right to ignore, much less to make it a means of detracting from another scientific man's opinions and arguments. Is the faith of the believer or the Christian shaken or destroyed by the Darwinian hypothesis? Is that hypothesis reconcilable with the truth, which we are taught by another process of reasoning and other authority to be divine? If either of these questions are answered affirmatively, then the scientific believer has a right to say to the Darwinian philosopher —Have you reduced your system to proof? Can you bring forward in its favour evidence sufficient to give a *prima facie* colouring of truth to it? And if the philosopher answers both or either of these questions in the affirmative, then I think such answer ought to be considered in the light of a challenge, and the question should be discussed on its merits. If, on the contrary, neither of these questions can be answered satisfactorily, then I think the scientific believer has a right to demand such proof to be forthcoming before he can be asked to give up his own faith, and he has a right to argue the subject in reference to an issue ten times more important than the knowledge of man's biological history.

The vast importance of the subject is well put by the reviewer of Darwin's last work on the 'Descent of Man' in the 'Edinburgh Quarterly' for July 1871: 'It is indeed impossible to overestimate the magnitude of the issue. If our humanity be merely the natural product of the modified faculties of brutes, most earnest minded men will be compelled to give up those motives by which they have attempted to live noble and virtuous lives, as founded on a mistake; our moral sense will turn out to be a mere developed instinct, identical in kind with those of ants and bees; and the revelation of God to us, and the hope of a future life, pleasurable day-dreams invented for the good of society. If these views be true a revolution in thought is imminent, which will shake society to its very foundations by destroying the sanctity of the conscience and the religious sense; for sooner or later they must find expression in men's lives.'[1]

The publication of Mr. Darwin's last work on the 'Descent of Man,' furnishes I presume, what we were told eleven years ago was to be a great work of which the 'Origin of Species' was the first instalment. The time is I think opportune for a review of the whole subject, and in venturing upon the task, I propose to treat it in a spirit of pure scientific investigation under the following heads:—

1. *The Physical Argument.*—Darwinism as it is presumed to derive support from the assumed correlation of the physical and vital forces.

[1] *Edinburgh Quarterly*, July 1871, p. 195–6.

2. *The Physico-Pschychical Argument.*—Darwinism as it is presumed to derive support from the doctrine of evolution as formulated by Mr. Herbert Spencer.

3. *The Variation and Natural Selection Argument.*—Darwinism as set forth by Mr. Darwin himself and his principal supporters.

4. *The Derivative Argument.*

5. *Mr. Darwin's line of Descent.*

6. *The Teleological Argument.*

7. *Evolution and Theology.*

CHAPTER II.

THE PHYSICAL ARGUMENT.

Darwinism as it receives support or otherwise from the assumed correlation of the Physical and Vital Forces.

Importance of the above argument to Darwinians.—Professor Tyndal on Physical and Vital Forces.—His views disproved.—Evidence of Professor Beale.—Dr. Stirling.—Professor Haughton and Professor Tait.

It is of great importance for the disciple of Darwin to establish, if possible, the formula at the head of this chapter, for it would enable him to argue that as the molecular changes in a crystal are produced by the force known as 'motion,' so in like manner may similar effects be caused in the organism of living beings. This, in fact, is the basis of the doctrine of evolution which has been worked out with great skill by Mr. Herbert Spencer in his 'First Principles of Philosophy,' and of which I shall have a good deal to say by-and-bye; but I may state *en passant* that the word evolution as formulated by Mr. Spencer has a very different meaning from that in which it has hitherto been used in biological researches.

I think I cannot put before the reader the doctrine of correlation of the physical and vital forces more clearly and more unmistakably than by quoting from the opening address of the President of the Mathematical and Physical Science Section of the British Association at Norwich in 1868, viz., Professor Tyndal:—

'When a solution of common salt is slowly evaporated, the water disappears, but the salt remains behind. At a certain stage of concentration the salt can no longer retain the liquid form; its particles, or molecules as they are called, begin to deposit themselves as minute solids, so minute indeed as to defy all microscopic power. As evaporation continues solidification goes on, and we finally obtain, through the clustering together of innumerable molecules, a finite mass of salt of a definite form. What is this form? It sometimes seems a mimicry of the architecture of Egypt. We have little pyramids built by the salt, terrace above terrace, from base to apex, forming thus a series of steps resembling those up which the Egyptian traveller is dragged by his guides. The human mind is as little disposed to look at these pyramidal salt-crystals without further question as to look at the pyramids of Egypt without inquiring whence they came. How then are these salt pyramids built up? Guided by analogy, you may suppose that swarming among the constituent molecules of the salt, there is an invisible population, guided and coerced by some invisible master, and placing the atomic blocks in their positions. This, however, is not the scientific idea, nor do I think your good sense will accept it as a likely one.

'The scientific idea is that the molecules act upon each other without the intervention of slave labour; and that they attract each other and repel each other at certain definite points, and in certain definite directions; and that the pyramidal form is the result of this play of attraction and repulsion. While then the blocks of Egypt were laid down by a power external to themselves, these molecular blocks of salt are self-posited, being fixed in their places by the forces with which they act upon each other.' Professor Tyndal takes common salt to illustrate his meaning, because it is so familiar to us all; but, he remarks, almost any other substance would answer as well, and continues: 'This structural energy is ready to come into play and build the ultimate particles of matter into definite shapes. It is present everywhere. The ice of our winters and of our polar regions is its handiwork; and so equally are the quartz, felspar, and mica of our rocks. . . . .

'This tendency on the part of matter to organise itself, to grow into shape, to assume definite forms in obedience to the definite action of force is, as I have said, all pervading. It is in the ground on which you tread, in the water you drink, in the air you breathe. *Incipient life in fact manifests itself throughout the whole of what we call inorganic nature.* . . . And now let us pass from what we are accustomed to regard as a dead mineral to a living grain of corn. When it is examined by polarised light, chromatic phenomena similar to those noticed in crystals are observed. And why? Because the architecture of the grain resembles in some degree the architecture of the crystal. In the corn, the molecules are also set in definite positions from which they act upon the light. But what has built together the molecules of the corn? I have already said regarding crystaline architecture that you may, if you please, consider the atoms and molecules to be placed in position by a power external to themselves. The same hypothesis is open to you now. But if, in the case of crystals, you have rejected the notion of an external architect, *I think you are bound to reject it now*; and to conclude that the molecules of the corn are self-posited by the forces with which they act upon each other. It would be a poor philosophy to invoke an external agent in the one case, and to reject it in the other. . . . . Let us place the corn in the earth and subject it to a certain degree of warmth. In other words, let the molecules both of the corn and of the surrounding earth be kept in a state of agitation—for warmth, as most of you know, is, in the eye of science, tremulous molecular motion. Under these circumstances, the grain and the substances which surround it interact, and a molecular architecture is the result of this interaction. A bud is formed; this bud reaches the surface, where it is exposed to the sun's rays, which are also to be regarded as a kind of vibratory motion. And as the common motion of heat, with which the grain and the substances surrounding it were first endowed, enabled the grain and those substances to coalesce, so the specific motion of the sun's rays now enables the green bud to feed upon the carbonic acid and the aqueous vapour of the air, appropriating those constituents of both for which the blade has an elective attraction, and permitting the other constituent to resume its place in the air. Thus forces are active at the root, forces are active in the blade, the matter of the earth and the matter of the atmosphere are drawn towards the plant, and the plant augments in size. We have in succession the bud, the stalk, the ear, the full corn in the ear; for the forces here at play act in a cycle which is completed by the production of grains similar to that with which the process began. . . .

'Given the grain and its environments an intellect the same in kind as our own, but sufficiently expanded might trace out *a priori* every step of the process, and by the application of mechanical principles would be able to demonstrate that the cycle of actions must end, as it is seen to end, in the reproduction of forms like that with which the operation began. *A similar necessity rules here to that which rules the planets in their circuits round the sun.* . . . But I must go still further and affirm that in the eye of science the *animal* body is just as much the product of molecular force as the stalk and ear of corn, or as the crystal of salt or sugar. . . . . Every particle that enters into the composition of a muscle, a nerve, or a bone, has been placed in its position by molecular force. . . . The formation of a crystal, a plant, or an animal, is, in the eye of many scientific thinkers, a purely mechanical problem which differs from the problems of ordinary mechanics in the smallness of the masses and the complexity of the processes involved.'

Professor Tyndal goes on to state 'that it is entirely probable that for every fact of consciousness, whether in the domain of sense, or of thought, or of emotion, a certain definite molecular condition is set up in the brain; that this relation of physics to consciousness is invariable, so that, given the state of the brain, the corresponding thought or feeling might be inferred.'

He then admits that our minds cannot in their present condition comprehend the 'WHY,' and that the materialist may hold his ground against all comers as far as I have quoted above, but no further. 'I do not think he is entitled to say that his molecular groupings, and his molecular motions explain everything. *In reality they explain nothing.* The utmost he can affirm is the association of two classes of phenomena of whose real bond of union he is in absolute ignorance. The problem of the connection of body and soul is as insoluble in its modern form as it was in the pre-scientific ages.'

I have made these long extracts because they place the subject fully, clearly, and fairly before us; and the intelligent reader will see at a glance the great significance to the biologist of this correlation of physical and vital forces. He may admit, without the slightest hesitation, the doctrine of spontaneous generation. At the Norwich meeting, which will ever be famous for startling announcements, Dr. Hughes Bennett expressed his belief in the formation of living organised cells from dead albuminous material, and Professor Huxley was inclined to adopt the same faith; but subsequently at Liverpool this distinguished biologist spoke strongly and forcibly against the doctrine. This will carry us far beyond the three or four organic forms from which Mr. Darwin believes all living things have sprung, and which have been through countless ages, by variation, natural selection, inheritance, intercrossing, and the struggle for existence, 'evolved' into their present forms of plants and animals in all parts of the world. I am very glad then to have so clear and able an exposition of the latest views held by scientific men upon the form of motion which they believe equally in the organic and inorganic world builds up the crystal, the plant, or the man.

Without wishing, however, to derogate from the well-earned fame of Professor Tyndal, I must take exception to his statement that the correlation of physical and vital force is a proved fact in science; and if it be not proved, then clearly it is wrong to make it the basis of a philosophical argument.

That the molecules of starch in a grain of wheat may be so posited in regard to chromatic phenomena as the molecules of a dead crystal are under similar circumstances, is only a proof that molecules of matter when placed in certain positions to each other produce like phenomena, with polarised light.

But the molecules which constitute a crystal, the movements of the heavenly bodies, and the living animal or plant, are formed and guided by the same Intelligence under totally different circumstances, which Professor Tyndal has altogether ignored. The crystal occurs as a solid body in five primitive forms or varieties of such forms.

The Euclidian solids as seen at the end of this chapter, are fashioned in the earth. Out of the earth they can only be formed by well-known formulæ which the highest wisdom of man has established upon mathematical laws. Reasoning man, unable to find out the 'Why' of such laws in the formation of crystals, is obliged by necessity to admit that the moving power must be superhuman. He knows the earth to be a geometer, but he does not believe with Kepler that it is a lazy animal going leisurely round the sun. He knows that a crystal is produced by high Intelligence; but he knows equally well that the earth is not intelligent; and again is he obliged by necessity to acknowledge that the crystal maker is a supreme Divine Intelligence acting externally to the solid body.

Again, he knows by exact science that the planets move round the sun, and maintain certain routes or orbits in doing so, by reason of a principle which he calls gravitation. But he is utterly ignorant of what this gravitation is. He sees it perform miracles of work which the highest human intellect has not hitherto fathomed, much less understood. Again is he driven by necessity to recognise a power external to the planets by which their vast movements are regulated; and he sees in the mode by which such motion is made nothing like chance. Every eventuality is provided for—now they go quick, now slow, but always with a distinct and special object.

Professor Tyndal and Mayer call such power mechanical force—Newton called it the hand of God. Professor Tyndal says, such movement is produced by law with which matter was originally endowed. Deep thinkers dispute such a position, and regard the movements of the planets as guided by an Omnipresent Divine Being.

Again, the growing plant, say for illustration a wheat plant, goes through certain wonderful changes in its life history, not only obedient to physical forces, but having in addition an active, selective, designing, discriminative living power, which superintends the positing of every atom, and produces not crystalization, but growth. These effects are evidently preordained, and end in perfecting every part of the organism, and giving it the means of perpetuating itself in time. That the same guiding hand is ever present here the contemplative thinker admits at once from necessity. He has no alternative. Professor Tyndal says it would be absurd to admit one power acting from without, and another from within. We do no such thing. We maintain that life is a force superadded to attraction; but that both are equally guided by the same Power.

Let us look at the question a little more closely.

It has been beautifully expressed by a late writer, that the tear which rolls down the cheek of sorrow is formed into a sphere by the same attributes of matter which have given that form to the earth we inhabit, the sun round which we move, or the planets which shine down upon us from above. Whether this attribute of matter is motion, according to the current philosophy, or not, is foreign to the purpose. But take Professor Tyndal's grain of wheat, and place it under the circumstances necessary for its growth, and what takes place?

Professor Tyndal says, that 'tremulous motion,' commonly called heat, will produce an interaction between the grain and the substances which surround it; and the molecular architecture of a bud is the result. But Professor Tyndal has only half stated the case. Heat, or 'tremulous motion,' will not produce the effects mentioned above. If the seed be placed where the atmospheric air cannot reach it, or where there is no water, the interaction stated by Professor Tyndall will not take place. Heat and moisture, heat and air, air and moisture, will not separately produce germination. It is essential for the process that heat, air, and moisture *should be combined.*

And why is this? Professor Tyndal's account is bald and inconclusive in the extreme. He says the grain, acted upon by tremulous motion, interacts with the substances which surround it, and a bud is formed. But is this all? Science tells us a very different tale. It tells us that in that grain of wheat there is a germ having life; that this living germ, if supplied with food, is in a position to *grow* which a crystal never does. Science also tells us that the germ, being within the seed, cannot at first obtain a supply of food from the atmosphere or soil; but that, by the combined action of heat, air, and moisture, the molecules of starch, which the cells of the embryo *cannot* absorb, are converted by chemical decomposition into molecules of sugar, which the cells of the embryo *can* absorb. The embryo then *grows.* It sends down into the earth delicate rootlets, which are tubes covered at their extremities with a porous membrane. It sends upwards a stem, which has a peculiar structure, upon which the existence of the world depends. It is necessary that that stem should be so coated with flint, that its texture may not be too brittle and be broken by the wind, or too soft to stand up as it rears its ears of grain above the earth. For this purpose the *cells* of the stem *select* from the watery mineral solutions brought up from the earth by the roots a silicate of potash, and then the cell further decomposes the silicate, and places or posits the molecules of flint in regular workmanlike order in the coats of the stem! Now, will

Professor Tyndal contend for a moment that this vital act of selection is performed by 'tremulous motion,' like the molecules of a crystal? Granted, that the molecules in each case may be posited in a similar way, so as to act in like manner upon the rays of polarised light. Why not? Is there not order in the universe? Are not like effects produced by like means? If the structure of the crystal, and its geometrical form—guided, as I believe it is, by the same external power which pervades all things in the universe—is perfect, why should the structure of the organic wheat plant not be perfect also? There is no proof whatever of a *living* structure being formed by the same 'tremulous motion' which posits the molecules of a crystal; albeit such motion is equally guided by intelligence. Still less reason is there to ignore a living, guiding, inscrutable force, superadded, in organic beings, to the 'tremulous motion' of the inorganic crystal.

Let us hear Professor Beale, one of the foremost physiologists of the age, upon the subject:—

'It has been shown that, besides the actions which may be explained upon the same principle as actions taking place in inanimate matter, there are changes in every living being, and in every cell, which cannot be so explained or accounted for, which are peculiar to matter derived from living beings. Whatever the real nature of these changes may be, they cannot result from the action of any ordinary force, nor do they obey the same laws. The seat of these peculiar actions has been pointed out, and has been distinguished from the seat of the physical and chemical changes.

'It will be remarked that the view of the vital processes advocated in these pages differs from others in the very essential point, that the assumed vital power is supposed to influence only particles of matter with which it is associated, and its association with matter is only temporary. The power bears neither a qualitative nor, as far as can be at present proved, a quantitative relation to the matter. It cannot act upon matter at a distance, nor upon the same particles for any length of time. The particles are influenced by it, but soon pass from its control. If their place is not succeeded by new particles, vital action must cease; but as long as new particles come into contact with those which live already, the action is transmitted, and so on for ever (not simply transferred from particle to particle, so that one gains what another has lost). The direction and control exerted are exerted upon particle after particle. The various particles are not placed in this or that place by a controlling power ordering and influencing all, but each particle for the time being seems to direct and control itself, and its power is transmitted to new particles without loss or diminution in intensity, and sometimes with actual increase.

'Certain physical conditions interfere with this power. The action of air, and various external circumstances, cause death. In fact, it would seem that inanimate matter, to become living, must come into contact with that which lives, only in exceedingly minute portions at a time. If much lifeless matter comes into contact with living matter, the latter dies. Death is simply the cessation of the vital changes, and is due alone to the action of physical conditions. Physical forces invariably cause death, but they cannot give rise to life. Ordinary force and life seem to be opposed.'[1]

In a still more recent work, Dr. Beale has further elucidated this subject. I quote the following:—

'There is a mystery in life—a mystery which has never been fathomed, and which appears greater the more deeply the phenomena of life are studied and contemplated. In living centres—far more central than the centre is seen by the highest magnifying powers—in centres of living matter, where the eye cannot penetrate but towards which the understanding may tend—proceed changes of the nature of which the most advanced physicists and chemists fail to afford us the faintest conception; nor is there the slightest reason to think that the nature of these changes will ever be ascertained by physical investigation, inasmuch as they are certainly of an order or nature totally distinct from that to which any other phenomenon known to us can be relegated.'[2]

[1] *Physiological Anatomy and Physiology of Man*, by Tod and Bowman. New edition. By L. S. Beale, M.D. Part i. pp. 35, 36.

[2] *The Mystery of Life, in reply to Dr. Gull's attack on the Theory of Vitality.* By L. S. Beale, M.B. P. 55. 1871.

'. . . During the last twelve years numerous facts, elucidated in the course of careful microscopical investigations on the tissues of plants and animals, which have not been called in question, tend to establish upon a firm basis the doctrine of "vitality;" or at least indicate that the phenomena peculiar to living beings are due to the working of some special power capable of guiding and directing and arranging ordinary matter, but in no way emanating from or correlated with ordinary material forces.'[1]

So much for the testimony of Dr. Beale, the hard-working, zealous, and able physiologist, who has been investigating the properties of living matter most of his life, and whose opinion is especially valuable as the result of such study; which can be said of very few of the physical doctrine school.

This subject is ably dealt with in a small pamphlet by Dr. James Hutchinson Stirling, termed 'As Regards Protoplasm in relation to Professor Huxley's essay on the Physical Basis of Life,'[2] from which I will make one or two extracts; but I would advise all interested in the subject to get the pungent and well-reasoned little pamphlet itself:—

'If we did invent the term aquosity, then, as an abstract sign for all the qualities of water, we should really do very little harm; but aquosity and vitality would still remain essentially unlike. While for the invention of aquosity there is little or no call;

[1] *Op. cit.* p. 64. [2] Blackwood and Sons.

however, the fact in the other case is, that we are not only compelled to invent, but to perceive vitality. . . . .

'There are certainly different states of water, as ice and steam; but the relation of this solid to the liquid, or of either to the vapour, surely offers no analogy to the relation of protoplasm dead to protoplasm alive. That relation is not an analogy but an antithesis—*the* antithesis of antitheses.

'In it, in fact we are in presence of the one incommunicable gulf—the gulf of all gulfs—that gulf which Mr. Huxley's protoplasm is as powerless to efface as any other material expedient that has ever been suggested since the eye of man first looked into it—the mighty gulf between death and life.[1]

'A drop of water once formed is there passive for ever, susceptible to influence, but indifferent to influence, and what influence reaches it is wholly from without. It may be added to, it may be subtracted from; but, infinitively apathetic quantitatively, it is qualitatively independent. It is indifferent to its own physical parts. It is without contractility, without alimentation, without reproduction, without specific function. Not so the cell in which the parts are dependent on the whole, and the whole on the parts, which has its activity and *raison d'être* within; which manifests all the powers which we have described water to want; and which require for its continuance conditions of which water is independent. It is only so

[1] *Op. cit.* p. 39.

far as organisation and life are concerned, however, that the cell is thus different from the water. Chemically and physically, as said, it can show with it quality for quality. How strangely Mr. Huxley's deliverances show beside these facts! He can "see no break in the series of steps in molecular complication;" but, glaringly obvious, there is a step added that is not molecular at all, and that has its supporting conditions completely elsewhere. The molecules are as fully accounted for in protoplasm as in water; but the sum of qualities thus *exhausted* in *the latter* is not so exhausted in the former, in which there are qualities due plainly, not to the molecules as molecules, but to the form into which they are thrown, and the force that makes that form one. . . .

'In protoplasms even the lowest then, but much more conspicuously in the highest, there is, in addition to the molecular force unsignalised by Mr. Huxley, the force of vital organisation.

'But this force is a rational unity, and that is an idea; and this I would point to as a second form of the addition to the chemistry and physics of protoplasm. We have just seen it is true that an idea may be found in inorganic matter as in the solar and sidereal systems generally. But the idea in organised matter is not one operative so to speak from without, it is one operative from within, and in an infinitely more intimate and pervading manner. The units that form the complement of an inorganic system are but independently and externally in place, like units in a procession;

but in what is organised there is no individual that is not sublated into the unity of the single life.'[1]

It is impossible to read such clear logical reasoning as this without pleasure. I will therefore make another extract. Dr. Stirling puts the case much more forcibly than I could myself:—

'In the smallest, lowest protoplasm cell, then, we have this rational unity of a complement of individuals that are only for the whole and exist in the whole. This is an idea therefore; this is design: the organised concert of many to a single common purpose. The rudest savage that should, as in Paley's illustration, find a watch, and should observe the various contrivances all controlled by the single end in view, would be obliged to acknowledge—though in his own way—that what he had before him was no mere physical, no mere molecular product. So in protoplasm: even from the first, but quite undeniably, in the completed organisation at last, which alone it was there to produce; for a single idea has been its one manifestation throughout. And in what machinery does it not at length issue? Was it molecular powers that invented a respiration—that perforated the posterior ear to give a balance of air—that compensated the *fenestra ovalis* by a *fenestra rotunda*, that placed in the auricular sacs those otolithes, those express stones for hearing? Such machinery! The *chorda tendineæ* are to the valves of the heart exactly adjusted check-strings; and the con-

[1] *Op. cit.* pp. 42, 43.

tractile *columnæ corneæ* are set in, under contraction and expansion, to equalise their length to their office. Membranes, rods, and liquids—it required the express experiment of man to make good the fact that the Inventor of the ear had availed Himself of the most perfect apparatus possible for his purpose. And are we to conceive such machinery, such apparatus, such contrivances merely molecular? Are molecules adequate to such things? molecules in their blind passivity and dead dull insensibility? Is it to molecular agency Mr. Huxley himself owes that "singular inward laboratory," of which he speaks, and without which all the protoplasm in the world would be useless to him? Surely, in the presence of these manifest ideas, it is impossible to attribute the single peculiar feature of protoplasm—its vitality, namely—to mere molecular chemistry. Protoplasm, it is true, breaks up into carbon, hydrogen, oxygen and nitrogen; but the watch breaks similarly up into mere brass, and steel, and glass. The loose materials of the watch—even its chemical materials if you will—replace its weight, quite as accurately as the constituents, carbon, &c., replace the weight of the protoplasm.

'But neither these nor those replace the vanished idea which was alone the important element. Mr. Huxley saw no break in the series of steps in molecular complication; but though not molecular, it is difficult to understand what more striking, what more absolute break could be devised than the break into an idea. It is of that break alone that we think in the watch; and it is of that break alone that we should think in the protoplasm which far more cunningly, far more rationally constructs a heart, an eye, or an ear. That is the break of breaks, and explain it as we may, we shall never explain it by molecules.'[1]

I will not apologise for making these long quotations. They strike, as we shall see, at the very root of evolution and Darwinism; and, like many other arguments included in volumes and articles written during the last ten years, they have never been answered.[2]

Professor Tyndall speaks vividly about the physical force which produces crystals. The following extract from a lecture delivered by Professor Haughton at the Royal Institution is still more eloquent, because it places the force brought into operation in the formation of a crystal in its true light:—

'The earth must be an intelligent animal for the highest and best of reasons, because it is a great geometer. The earth produces within its bosom many crystals, having certain specific forms, as shown in the figures of Euclidean solids (p. 36). No one can know or make these five solids except an intelligent geometer; but the earth produces them, and therefore by the

[1] *Op. cit.* pp. 43–45.

[2] The short allusion to Dr. Stirling's pamphlet, *Quarterly Journal of Microscopical Science,* vol. x. p. 410, New Series, is only remarkable for its want of candour when it remarks that 'only bibliographical knowledge is brought to bear upon such a question as Protoplasm.

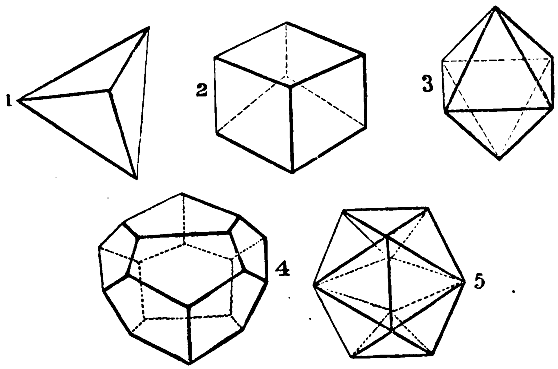
rule *de opifice testatur opus*, "the carpenter is known by his chips," the earth must be a geometer.'[1]

And I close this part of my subject with an extract from the sectional address of Professor Tait, the President of the Mathematical and Physical Sciences section of the British Association at Edinburgh, 1871:—

'There must always be wide limits of uncertainty (unless we choose to look upon physics as a necessarily finite science) concerning the exact boundary between the attainable and the unattainable. One herd of ignorant people, with the sole *prestige* of rapidly-increasing numbers, and with the adhesion of a few fanatic deserters from the ranks of science, refuse to admit that all the phenomena even of ordinary dead matter are strictly and exclusively in the domain of physical science. On the other hand, there is a numerous group, not in the slightest degree entitled to rank as physicists—though in general they assume the proud title of philosophers—who assert that not merely life, but even volition and consciousness are mere physical manifestations. These opposite errors, into neither of which is it possible for a genuine scientific man to fall—so long at least as he retains his reason—are easily seen to be very closely allied. They are both to be attributed to that credulity which is characteristic alike of ignorance and of incapacity. Unfortunately there is no cure—the case is hopeless; for great ignorance

[1] Lectures at the Royal Institution by Professor Haughton.

almost necessarily presumes incapacity, whether it shows itself in the comparatively harmless folly of the spiritualist or in the pernicious nonsense of the materialist. Alike condemned and contemned we leave them to their proper fate—oblivion.'



1. Tetrahedron. 2. Cube. 3. Octahedron.
4. Pentagonal Dodecahedron. 5. Icosahedron.

CHAPTER III.

THE PHYSICO-PSYCHICAL ARGUMENT.

Darwinism as it is presumed to derive support from the doctrine of Evolution formulated by Mr. Herbert Spencer.—Mr. Spencer's definition of Evolution.—The difficulties of arguing against Darwinism. —The 'Unknowable.'—Ultimate Scientific ideas.—Space and Time. —Reason consists in power of Comparison.—Existence of good and evil explained.—Motion.—Force.—Sir Isaac Newton's explanation of the 'why' of gravitation.—Consciousness.—Man not conscious of his own existence.—The dogma disproved.—Questions which spring from Mr. Herbert Spencer's arguments.

Mr. Herbert Spencer defines evolution in the sense used by the Darwinian school as follows:— '*Evolution is an integration of matter and concomitant dissipation of motion, during which the matter passes from an indefinite, incoherent homogeneity to a definite coherent heterogeneity; and during which the retained motion undergoes a parallel transformation.*'[1]

Interpreted by the close reasoning of the 395 pages which precede this formula in the work indicated, its meaning is obvious enough. As an explanation of the mode by which organic nature, as seen in the world around us, has been produced, it is, in my humble opinion, utterly incomprehensible.

Mr. Herbert Spencer is undoubtedly, as stated by

[1] *First Principles*, vol. i. p. 396.

Dr. Hooker in his Norwich address to the British Association, one of the 'deepest thinkers of the day.' More than that, he is one of the ablest writers of our time.

It is one of the acknowledged and great difficulties, in arguing against the Darwinian hypothesis, that its leading supporters are men of great mental endowments. Darwin, Huxley, Hooker, Tyndall, and Spencer, are men of the highest scientific position and acquirements; and it would be a thankless and hopeless task for anyone to enter the lists against such a force, were it not that they have a weak spot which is assailable in all of them, viz. their biological faith. They begin, continue, and end their reasoning with a common belief, and all their arguments and illustrations are more or less coloured by their evident desire to add something to the structure of Darwinism.

If this structure, however, should turn out to be a fabric of the imagination, if it should prove unsound in its foundations, and not built up with good mortar, it will most assuredly tumble down; and in its ruins will vanish the various theories by which it has been attempted to prove that it must stand. In no one's writings does the biological student feel the full force of the difficulties he has to encounter more than in the writings of Mr. Herbert Spencer. His language is clear and forcible. He carries you along his pages, a willing and attentive follower, until suddenly he shoots out in a tangent and lands you in some startling deduction from which you strive to get away, and during the struggle he will come himself to your assistance and make things all smooth again.

Thus, in treating of the 'unknowable,' he leads you from argument to argument to the conclusion that Atheism, Pantheism, and Theism, when rigorously analysed, severally prove to be absolutely unthinkable. 'Instead of disclosing a fundamental verity existing in each, our investigation seems rather to have shown that there is no fundamental verity contained in any.'

Immediately after this passage he tells us that 'to carry away this conclusion would be a fatal error,' and then he proceeds to prove that 'a religious creed is definable as an *à priori* theory of the universe.' His proof of this is, that in all creeds there is a community of belief in one thing, viz. that there is a mystery 'ever pressing for interpretation,' and this he states to be the abstract truth, the vital element in all religions. 'A God understood would be no God at all;' and such a belief, he further states, 'the most inexorable logic shows to be more profoundly true than any religion supposes.' And further, he argues that the attempt to solve this mystery, and the assertion that it is not a mystery passing human comprehension, always fails of proof. . . . 'The analysis of every hypothesis proves, not simply that no hypothesis is sufficient, but that no hypothesis is thinkable. . . . If Religion and Science are to be reconciled, the basis of reconciliation must be this deepest, widest, and most certain of all facts, that the Power which the universe manifests to us is utterly inscrutable.' (Pp. 45–6.)

In the next chapter, Mr. Spencer treats of 'ultimate scientific ideas,' and it is important that we should follow his train of argument closely.

He begins by asking 'What are Space and Time?' He takes three pages to show that they are wholly incomprehensible. This will appear to any candid and unbiassed enquirer to be mere waste of time, for there are certain things which a man's consciousness tells him at once are beyond the grasp of human intellect. If philosophers would be satisfied with this self-evident fact, we should be saved many useless speculations and much unnecessary thought and study. Human reason is as limited in its powers as a man's muscular or nervous functions. Consisting, as I think it can be proved, essentially in the power of comparison, it follows that, if a man cannot compare within the limits of human reason, he is mad; and I do not think it is too great a stretch of imagination to say that, if he attempts to compare beyond the limits of human reason he is mad also. How often do we hear eloquent preachers in the pulpit describe the existence of evil in the world as a great and inscrutable mystery. But the slightest reflection shows us that, if it did not exist, we should be unable to realise that which is good, because we should have no standard of comparison. People talk of the permission of evil very much in the same way as Friday said to

Robinson Crusoe, 'Why God no kill de devil?' Goodness having been founded in the world by the Author of all good, evil is but a falling away from the standard of comparison; and, when human actions and human hearts are compared, they are evil, inasmuch as they fall away from the one standard of goodness.[1]

Conversely, if the finite mind attempts to solve the attributes of the Infinite, the conclusions he draws can be of no scientific value, because, not being formed by comparison, they cannot be the result of sound reasoning. Why, therefore, I ask, waste time by attempting to explain things which cannot be compared? Space, time, indivisibility of matter, are unthinkable, because incomparable. But, in section 17 of the chapter now under consideration, Mr. Spencer treats of Motion, and in 18 of Force, both of which, he argues, are inconceivable; and as these are the bases of his formula of evolution, it is necessary to look into his argument.

The croquet wire on my lawn, now before me, I know, by comparison with the ball which is passing through it, to be at rest; and, when the ball stops, the previous mental comparison shows me that the ball is at rest also. But Mr. Spencer dissipates these conclusions, or, as he would call them, delusions.

[1] I take upon myself alone the responsibility of this statement. I think it can be proved logically, but this is not the place to argue the question.

He tells you that neither the ball nor the wire are at rest, because the world is going round upon its axis, and also at an enormous rate round the sun; and, at the same time with the whole solar system, towards the constellation Hercules. Now all this is very true; in reality everything, though we do not realise the fact, is perpetually in motion. But, with all due deference to Mr. Spencer, I must withdraw my thoughts from the movements of the spheres and fix them where my reason can compare on things below. My croquet wire is certainly at rest as far as its physical position on my lawn is concerned, and the ball which is passing through it is as certainly in motion; I can, therefore, compare and form two rational and logical ideas of rest and motion. Neither can Mr. Spencer's reasoning deprive me of that knowledge—it is final and conclusive. If I spin a teetotum on a plate it moves as long as it spins, and rests when it has done. If I then move the plate, I do not give renewed motion to the top, it still remains at rest. As to the nature of motion, the WHY the earth goes round the sun, this is beyond the reach of my finite reason. I have no force with which to compare the forces that produce this movement, and therefore I cannot understand nor reason upon it.

It is said of Sir Isaac Newton that, when asked about the reason why the apple fell to the ground—upon which, as is well known, his grand discovery of gravitation was founded—he answered, 'It is beyond the limit of human reason, it is the will of God.' Had the great philosopher lived in these days, he would most assuredly have been accused of intruding religious belief into the domain of science; or even such an answer might have subjected him to the charge of raising the *odium theologicum,* by some of the shallow critics of the day. But has our knowledge advanced since the days of Newton sufficiently to enable us to give an answer now? Let us hear Mr. Herbert Spencer:—

'While, then, it is impossible to form any idea of Force in itself, it is equally impossible to comprehend either its mode of exercise or its law of variation.'

This is simply a confession that our knowledge on this subject has not advanced since the days of Newton. Why, then, found a theory of evolution upon that which you cannot understand? Not only does Mr. Spencer argue that force, space, and time are incomprehensible, but he carries his argument still further, and he tells us that consciousness is in the same predicament. 'Belief in the reality of self is indeed a belief which no hypothesis enables us to escape,' and yet what does he say further on?—'But now, unavoidable as is this belief—established though it is, not only by the assent of mankind at large, endorsed by divers philosophers, but by the suicide of the sceptical argument—it is yet a belief admitting of no justification by reason; nay, indeed, it is a belief which reason, when pressed for a distinct answer, rejects.' And here is the mode of reasoning by which philosophers argue away a man's knowledge of his own existence. 'The fundamental condition to all consciousness, emphatically insisted upon by Mr. Mansell, in common with Sir William Hamilton and others, is the antithesis of subject and object. And on this primitive dualism of consciousness, "from which the explanations must take their start," Mr. Mansell founds his refutation of the German absolutists. But now, what is the corollary from this doctrine as bearing on the consciousness of self? The mental act in which self is known implies, like every other mental act, a perceiving subject and a perceived object. If, then, the object perceived is self, what is the subject that perceives? Or, if it is the true self which thinks, what other self can it be that is thought of? Clearly a true cognition of self implies a state in which the knowing and the known are one, in which subject and object are identified; and this Mr. Mansell rightly holds to be the annihilation of both.'

I quote the above passage to show the style of argument adopted by Mr. Spencer; by which, in fact, he reasons away every kind of belief we possess. But I think the fallacy and unsoundness of the above process of reasoning can be easily demonstrated, and yet the argument shall be in accordance with the dogma of Mr. Mansell and Sir W. Hamilton.

Every human being is in fact dual. He possesses a corporeal frame and a spiritual frame. The spiritual frame thinks and is conscious, and therefore knows that the body is that of self; it also thinks and reasons subjectively, and knows thereby that the objective body has also an objective spirituality. What more does the logician require? You cannot reason and prove the existence of the human spirituality as you do with the corporeal. The latter you can compare with other like bodies and so reason upon its physical qualities; the former, having neither length, breadth, nor solidity, is incomparable, and therefore beyond the limits of the human reason—it cannot be compared, and therefore is undefinable and indescribable.

I am willing to admit, with Mr. Herbert Spencer, that 'ultimate scientific ideas are all representative of realities that cannot be comprehended.' Our method of coming to this conclusion is, however, very different.

Now, two very natural questions suggest themselves at this point of the enquiry:—

1. Is the 'inexorable logic' which culminates in the grand idea that man cannot be conscious of his own existence, the kind of science upon which a rational and reasoning being will admit the soundness of the hypothesis that all organic things have been evolved from beings of less complex structure than themselves by natural selection and inherited variability?

2. If it be admitted that the ultimate facts of science represent realities which we cannot comprehend, is it

sound logic to found upon such facts or their laws a formula of evolution?

Before, however, asking for a verdict upon these questions, let us take a glance at Mr. Herbert Spencer's method of reasoning out the formula in question.

CHAPTER IV.

THE PHYSICO-PSYCHICAL ARGUMENT CONTINUED.

Consciousness definite and indefinite.—The 'Knowable.'—Examination of Mr. Spencer's formula of Evolution.—Its unsoundness proved.—Mr. Spencer's theory of development.—Van Baer's views.—Embryological resemblances not likenesses.—The subject discussed.—Professor Owen on the Embryo.—Mr. Spencer's doctrine of physiological units as a substitute for selective cell power.—The mythical nature of physiological units.

In the chapter on the 'Relativity of all knowledge,' Mr. Spencer differs from Sir W. Hamilton and Mr. Mansell as to the belief in something beyond the mere consciousness of phenomena—in other words, that we may believe in things 'beyond the relative,' or as it may be simply stated, beyond comparison—and he thus expresses himself:—

'Besides that *definite* consciousness of which logic formulates the laws, there is also an *indefinite* consciousness which cannot be formulated. Besides complete thoughts, and besides the thoughts which though incomplete admit of completion, there are thoughts which it is impossible to complete, and which are still real in the sense that they are normal affections of the intellect.'

I quote this passage because it is an important part of Mr. Spencer's system.

We will now pass over the 'unknowable,' and take a glance at the 'knowable,' and it is here that Mr. Spencer principally works out his formula of evolution. Let us tabulate the principal items of this formula, and remember that if any of them are untrue the formula itself tumbles to pieces, and with it Mr. Spencer's Darwinian doctrine of the origin and formation of species. This formula consists—

1. In the statement that it is an integration of matter;

2. A concomitant dissipation of motion;

3. The passage of matter while being integrated from an indefinite incoherent homogeneity to a definite coherent heterogeneity;

4. And a simultaneous parallel transformation of the retained motion.

1. The integration of matter.

A good idea of what Mr. Spencer means by this may be gathered from the following:—

'Every mass, from a grain of sand to a planet, radiates heat to other masses, and absorbs heat radiated by other masses; and in so far as it does the one it becomes integrated, while in so far as it does the other it becomes disintegrated.'[1] Integration of matter, therefore, is the absorption of heat, and heat we are told by Tyndall, endorsed by Mr. Spencer, is 'tremulous motion'—therefore integration of matter

[1] *Op. cit.* p. 283.

is the absorption of motion. But previously, at p. 169, Mr. Spencer tells us that 'matter and motion, as we know them, are differently conditioned manifestations of force.' But what is force? This Mr. Spencer describes as the 'ultimate of ultimates.' Though space, time, matter, and motion are apparently all necessary data of intelligence, yet a psychological analysis shows us that these are either built up of, or abstracted from, experiences of force. '*It is a truism to say that the nature of this undecomposable element of our knowledge* (*force*) *is inscrutable*' (pp. 169–170).

We therefore clearly arrive at the conclusion that the integration of matter is equal to the integration of motion, which is equal to the integration of force, which is an ultimate element of our knowledge, and therefore inscrutable.

2. Dissipation of motion is equal to dissipation of force, which is inscrutable.

3. The passage of matter while being integrated from an indefinite incoherent homogeneity to a definite coherent heterogeneity.

This portion of Mr. Spencer's formula of evolution is founded upon Van Baer's admitted biological law, that during the growth of the embryo each organ passes from a state of homogeneity to a state of heterogeneity. In other words, the line of development is from the simple to the complex—a law which everyone can realise for himself by comparing the contents of an egg with the structure of the perfect chicken. In Mr. Spencer's formula of evolution, of course the law is intended to have greater significance, but as he considers—

4. That there is a simultaneous parallel transformation of the retained motion which is equal to force, which is inscrutable, I think we need not waste further time in discussing the nature of a formula which is by its very nature absurd.

I dare say the 'deep thinkers of the age' will be very angry with me for dealing thus trenchantly with their favourite so-called science; but I have no doubt that the rational thinkers of the age will agree with me in denouncing as absurd the idea that man is not, and cannot be, conscious of his own existence, or that matter is a conditioned manifestation of force. For when we find such elements the basis of a formula by the operation of which all organic nature has been evolved—when, in other words, we find that the laws of matter are not only held to be equivalent to matter itself, but to the laws of life also; and that all the beautiful structure of parts, and the still more beautiful adaptation of those parts to the circumstances of their being, have resulted from the same force that formed the crystal, or that makes the planets revolve round the sun—then indeed do we begin to doubt the soundness of such a reasoner's logic, and the belief creeps in upon us that the human mind has been stretched beyond its legitimate limits to satisfy the 'inexorable' rules upon which such logic is founded.

This is a grave and deeply important subject. Far, far beyond the question how living things have come into being, is the all-absorbing one as to the highest of created things, and his position in the world around him. His past, his present, his future are realities which have been consecrated upon the altar of a great belief, by the most profound scholars and the deepest thinkers of ages which boasted of greater men than the present generation has seen. This belief is the soul of man's existence on earth. It is that which exalts him far above all other organised things. It is the beautiful but mystic light which has shone upon his otherwise unknown future. It is that which supports him in misfortune and sorrow. It is that which gladdens his heart when all around him is dark and cold and cheerless. For the sake then of what we value here and hereafter, let us not cast away such a belief for the weak and illogical and unproved, and, as I believe, unprovable hypothesis which tells us that the world around us has risen in its majestic beauty at the bidding of blind force or a chance variation.

I shall hereafter go further into this subject. It is necessary now to pursue the even tenor of my way, and I propose to follow Mr. Herbert Spencer from his 'First Principles' to his 'Principles of Biology.'

It is not within the limits of this work to enter into a criticism or review of the two large octavo volumes which Mr. Spencer has devoted to this subject. The scope of his reasoning will be sufficiently evident if we discuss first his opinion upon 'Development,' and then deal with the chapters in vol. i. on 'The Special-Creation Hypothesis,' and that which follows on 'The Evolution Hypothesis.'

The great point insisted upon by Mr. Spencer in his theory of development—by which term is meant the formation of organic *structure*, which is thus easily distinguished from *growth*—is the well-known and indisputable fact that its line of action is from the simple to the complex; and, like all other biologists of the Darwinian school, he dwells much upon the apparent resemblance of the earlier forms of development in man, and the successive stages passed through by other animals beneath him in the scale. It is not meant by this that the human embryo is ever like a bird, a reptile, or a fish; but simply that, judging by external appearances, a similar method is adopted in development producing in early embryonic conditions a likeness in external appearance between say a man and a dog. From this similarity of external characters, a strong inference is drawn that there is a common origin between the two mammals above mentioned. This is a favourite argument with Mr. Huxley, who, in his work entitled 'Man's Place in Nature,' gives figures of the canine and human embryo, and draws particular attention to the fact that 'it is a very long time before the human being can be readily discriminated from that of the young puppy.'[1] After a

[1] Mr. Darwin excludes the dogs from man's line of descent. See Table in Frontispiece.

time the human embryo ceases to be like that of the dog; but now exactly in those respects which he differs from the dog does he 'resemble the ape,' and 'it is only quite in the latter stages of development that the young human being presents marked differences from the young ape, while the latter departs as much from the dog in its development as the man does.

'Startling as the last assertion may appear, it is demonstrably true, *and it alone appears to me sufficient to place beyond all doubt the structural unity of man with the rest of the animal world, and more particularly and closely with the apes.*'[1]

Mr. Spencer puts the statement in the following intelligible words:—

'The germ out of which a human being is evolved differs in no visible respect from the germ out of which every animal and plant is evolved. The first conspicuous structural change undergone by this human germ is one characterising the germs of animals only, and differentiates them from the germs of plants. The next distinction established is one exhibited by all vertebrata, but never by annulosa, mollusca, or cœlenterata. Instead of continuing to resemble, as it now does, the rudiments of all fishes, reptiles, birds, and mammals, the rudiment of a man assumes a structure seen only in the rudiments of mammals. Later the embryo undergoes changes which exclude it from the group of implacental mammals, and prove

[1] *Man's Place in Nature*, pp. 63-7.

that it belongs to the group of placental mammals. Later still it grows unlike the embryos of those placental mammals distinguished as ungulate or hoofed, and continues to resemble only the unguiculate or clawed. By and by it ceases to be like any fœtuses but those of the quadrumana, and eventually the fœtuses of only the higher quadrumana are simulated. Lastly, at birth the infant, belonging to whichever human race it may do, is structurally very much like the infants of all other human races, and only afterwards acquires those various minor peculiarities of form that distinguish the variety of man to which it belongs.' [1]

These are the facts discovered by Van Baer; but Mr. Spencer adds with truthful candour what the student will readily enough infer for himself if he will consult Mr. Huxley's figures :—

'The reader must also be cautioned against accepting this generalisation *as exact.* The likenesses thus successively displayed are not *precise*, but approximate. Only leading characteristics are the same, not all details.'

But exact or not, the evolutionist and Darwinian draw much capital from these facts. They say that this similarity in an embryonal condition between the different phases of development in the animal kingdom indicates an intimate connection of structure which has resulted from an original community of origin,

[1] *Principles of Biology*, vol. i. p. 143.

and that each animal has throughout countless ages been differentiated into their several now existing forms by 'arrested development,' 'natural selection,' and 'the struggle for existence.'

But what real force is there in this argument for community of origin? Literally none whatever. In the first place, there is a real and significant difference in the embryo of man, as compared with brutes, from the earliest period of its structural existence. The first indication of structural growth in the embryo of the mammal is the formation of a nervous axis, which has the appearance of a double chord—one partition of which is the rudiment of the future nervous system, the other that of the alimentary canal; and between these appear the first rudiments of the skeleton, in the form of a 'gelatinous cylinder in a membranous sheath,' called the 'notochord,' or 'chorda dorsalis.' Now, this notochord developes two plates— one the 'neurad,' to enclose the nervous axis, and the other the 'hæmad,' to enclose the vascular axis. But the 'notochord' of man can at this early stage be *at once distinguished from that of brutes* by the position of these plates, the 'neurad' being 'backward in man and upward in beasts;' the 'hæmad' being 'forward in man, downward in beasts.'[1]

For obvious reasons, it is impossible to investigate this subject in man as it ought to be; but the instance I have given is sufficient to upset the whole series of

[1] Owen, *Anatomy of Vertebrates*, vol. i. p. 2.

arguments and deductions which have been drawn from this supposed resemblance. That there is a similarity in the external appearance of the various phases of the embryo of the highest mammal to that exhibited by other animals below him in the scale, as shown by Van Baer, is undoubted. But what of this? It merely exhibits a unity of plan, which is one of the grand characteristics of the organic world. All organisms being formed by the addition of new matter, their embryonic condition is similar, as the foundations of a cottage and those of a castle are similar. In both cases a complex structure is formed from a simple one by the addition of new material; or, in the learned words of science, by the 'integration of matter,' and the transition from the 'homogeneous' to the 'heterogeneous.' But the intellect of the architect rears upon these foundations very different structures. Who so absurd as to say that the castle was 'evolved' from the 'cottage,' because their foundations were similar, or even some of their rooms alike?

The answer to this question must be the same as that which can be given to the evolutionist who claims a community of origin in the organic world, because there is a resemblance between their early conditions. Neither is true. But I go further than this. I say that it can be proved to a demonstration that the growth and perfection of organic nature is presided over by a Divine Architect, by whose will and power alone are they built up.

'A perch,' says Professor Owen, 'a newt, a dog, a man, does not begin to be such only when the embryologist may discern the dawnings of their respective specific characters. The embryo derived its nature and the potency of self-development according to the specific plan at the moment of impregnation, and each step of development moves to that consummation as its end and aim.'

But there is a great difficulty in development, which it is necessary for Mr. Spencer to meet, viz., what is termed 'selective assimilation.' Why does the liver, for instance, gather to itself liver material; the lung, lung material; the heart, heart material; the brain, brain material? Exactly, says Mr. Spencer, as a crystal will select from two forms in solution the one which is like itself. 'Particular parts of the organism are composed of special units, or *have the function* of secreting special units which are ever present in them in large quantities. The fluids circulating through the body contain special units of this same order; and these diffused units are continually being deposited along with the groups of like units that already exist.'

This theory of physiological units has been expanded by Mr. Darwin into his theory of Pangenesis.[1] It may be true, but it no more accounts for selective assimilation than it does for the cause of disease, examples of which are adduced by Mr. Spencer. 'Cancer cells having begun to be deposited at a

[1] *Animals and Plants under Domestication,* vol. ii.

particular place, continue to be deposited at that place.' This is not even true in fact, because cancer cells do not increase by segregation, but by a regular process of cell development. 'Tubercular matter making its appearance at particular points, collects more and more round those points.' Again is Mr. Spencer's illustration most infelicitous. It is true that tubercle is deposited from the blood in the particular organ it affects; but every pathologist knows quite well that it is first laid down *diffused* over a considerable portion of the organ—say the lungs—and that some of these points of deposit increase, unite, soften, and destroy their victim. Pustular diseases are increased by cell development, like cancer. Thus do Mr. Spencer's illustrations of physiological units, as the true cause of selective assimilation, signally fail.

CHAPTER V.

THE PHYSICO-PSYCHICAL ARGUMENT CONTINUED.

Special Creation: its denunciation by Mr. Spencer.—'Special Creation' a 'Belief' not an hypothesis.—This 'Belief' supported by Science. —In the beginning Special Creation must have been exercised even according to the theory of the Evolutionist.—Which is true?—The teleological argument best supported by facts.—Primitive notions of mankind.—Mr. Spencer's views considered.—Mistaken beliefs.—Line between Evolution and Special Creation defined.—Creation not a pseud-idea, but an ultimate fact in Science, and 'unthinkable.'—The teleological argument.—The reasoning of Galileo compared with the theory of Evolution.—Every theory of Evolution must admit a special creative act.—The doctrine of Special Creation highly intellectual and a strengthener of the moral sense.—The question of cruelty and parasitism in nature not a proof of malevolence.—Some of the mysteries of nature not to be accounted for.—Overwhelmed by the goodness of the Deity.

I NOW come to the chapter on 'The Special-Creation Hypothesis,' which Mr. Spencer considers to be 'worthless: worthless by its derivation; worthless in its intrinsic incoherence; worthless, as absolutely without evidence; worthless, as not supplying an intellectual need; worthless, as not satisfying a moral want. We must, therefore, consider it as counting for nothing in opposition to any other hypothesis respecting the origin of organic beings.'[1]

[1] *Principles of Biology*, vol. i. p. 345.

In his address at Norwich, Dr. Hooker repudiated special creation in language equally decided.

I will examine Mr. Spencer's objections *seriatim*, without commenting upon the peculiar nature of the language in which they are conveyed.

1. 'The special-creation hypothesis is worthless, by its derivation.'

And here Mr. Spencer, in common with a host of other naturalists, makes a great mistake. What he terms the special-creation hypothesis is simply a belief, and the term is used in the scientific argument as the simple expression of a great truth proved by a process of reasoning which leaves no doubt upon the mind, unless warped by peculiar dogmas, not a whit more probable and infinitely more difficult to comprehend.

Now, when Mr. Herbert Spencer asserts that the doctrine of special creation is worthless, he is simply stating that all arguments upon the subject are worthless, and this is a style of reasoning which is not philosophical. There must have been a beginning; and no process of argumentation can get rid of the fact that something was made in the beginning, and that great laws were associated with matter. This must have been pure special creation, and if Mr. Spencer's argument has any force, it applies equally to the beginning as to the present time; and must consequently put an end to his own theory of evolution. There would be no greater miracle in creating a man, than there would be in creating a grain of protoplasm and endowing it with potentiality for all time. The question to decide is, which of the alternatives is true—Mr. Spencer's special creation, or the special creation of the teleologist. All that is written about the greatness and goodness and power of a Creator being equally evinced in both cases, does not prove either of them to be true. The argument is between two modes of creation; and the question is, not what suits the dogmas or the requirements of scientific men? but which is supported by the greater number of facts and the soundest and best arguments? I reject *in toto* the potentially endowed protoplasm, or the meteoric mass, and the evolution of species; not from prejudice, not from education, not from bias, but simply because I find the teleological argument is better supported by facts, and is, as I conceive, irresistible from the vast mass of evidence in its favour.

Now let us hear what are Mr. Spencer's arguments.

1. That the belief in a special creation is derived from 'the primitive notions of mankind,' which he says were wrong as to 'the structure of the heavens,' the 'nature of the elements,' the 'interpretation of mechanical facts,' of 'meteorological facts,' of 'physiological facts.'

But what a false, loose style of reasoning is this! Surely Mr. Spencer must admit that the intellectual history of mankind has been progressive, and that the facts of the natural world have been understood only as the science which explains such facts has progressed with the advancement of time? How could men correctly interpret the facts of science before the creation of science itself? In a primitive state of society men interpreted facts by the little light they possessed; and, as the human intellect expanded by education from one generation to another, so did science progress; and it is no reflection upon a past age that one more advanced should have corrected its errors.

A belief in special creation has increased *pari passu* with civilisation and increased knowledge; and, so far from its being a mere belief referrible to the early ages of mankind, it was never put strongly before the world till the great progress of science enabled philosophers to take their arguments and their proofs from its stores.

Again, Mr. Spencer tells us, 'To the improbability of a belief in special creation is to be added its association with a special class of mistaken beliefs.' He then carries us back to the savage and his 'fetish' worship, to Kepler's 'guiding spirit,' and the succession of storm and sunshine and epidemics as inflictions of angry deities, and madness as the result of demoniacal agency. The majority of these beliefs have, true enough, as Mr. Spencer remarks, become extinct. But none of them were founded upon evidence like that demanded by science and elucidated by the teleological argument, to prove the external, direct, and superintending action of a superior intelligence in the creation and development of the universe and of all things dead or living therein. To prove this there is not any necessity to refer to the Mosaic account. The evidences and proof are found in the things created. The evolutionist will tell you that the beautiful plumage of the males of many birds was produced by the influence of female preference for a gaudy over a dull-coloured helpmate. The believer in special creation says: I deny that anything is fortuitous. It is part of the plan of creation that the sense of beauty should be gratified, and that created things should gladden the heart and soften the feelings, and give a higher direction to the intellectual aspirations of those who reflect and ponder upon the great scheme. The sense of beauty is one of the most humanising attributes of humanity, and things of beauty are among the most convincing evidences of design. Surely the line between evolution and special creation is sufficiently indicated by the above example.

Some of the disciples of the former will say: 'No, I believe in evolution, but I append to it the supervision of a superior intelligence.' But this is simply the belief in special creation, with a description by an inferior intelligence of the means by which the higher works. Others will say: 'I believe in the evolution of a potentially endowed speck of protoplasm acting by physical laws throughout all time.' Even this kind of evolution does not square with Mr. Darwin's theory of sexual selection. But I am anticipating. The ground, however, over which we have to work will be all the more clear.

The above explanation of the real difference between special creation and evolution will also be a sufficient answer to the following strange sentence written by Mr. Spencer:—

'For where did he get (any well-informed man) the doctrine of special creation? Catechise him, and he is forced to confess that it was put into his mind in childhood as one portion of a story which, as a whole, he has long since rejected.'

2. 'Special creation is worthless by reason of its intrinsic incoherence.'

Mr. Spencer, in dilating upon this text, says that in fact the doctrine of special creation 'cannot be framed into a coherent thought.' It is an 'illegitimate symbolic conception,' a 'pseud-idea admitting of no definite shape;' and he gives us a fanciful idea of his own that we believe 'myriads of atoms going to the composition of a new organism, each suddenly disengaging itself from its combination, rushes to meet the rest, unites with them into appropriate chemical compounds, and then falls with certain others into its appointed place in the aggregate of complex tissues and organs.' All this is gratuitous. The believer in special creation does not believe anything of the kind; but, just as Mr. Spencer himself must come to the conclusion that time, space, and eternity are unthinkable, so do we believe that the creation of living things is unthinkable. We do not believe there is anything miraculous in the fact at all. It is simply a part of the great scheme which we cannot, nor probably ever shall understand. Mr. Spencer says that *we believe we believe.* Be it so. The delusion, if it is one, pledges us to no theory, neither does it land us on the cold platform of unbelief.

3. 'Special creation is worthless, as absolutely without evidence.' [1]

I reply that the whole of organic and inorganic existences are evidence of special creation.

If I take up a straw, as Galileo did to the Inquisitor, and show how, by being built up hollow and coated with flint, it was inimitably adapted to the circumstances of its existence—that the hollow stem gave it at the same time lightness and strength—that the flint for coating was *selected* by the cell of the growing stem and placed as a bricklayer would lay his bricks in building a chimney. And when I further say that, upon the power of this insensate and unreasoning plant to perform, under the special direction of an external Intelligence, this admirable piece of work, the existence of the human race and of the higher animals entirely depended—then I say to Mr. Spencer, I have logically produced evidence of special creation.

Now, look for a moment on the other side of the

[1] *Op. cit.*

picture. Evolutionism requires that the original organic matter from which all living things are evolved should be potentially endowed with certain secondary laws, and, by virtue of this endowment, every living thing should become what it is in nature. One can readily understand that a lump of protoplasm might have the same physical laws attached to it as a crystal, plus the existence of life. But when our speck of protoplasm becomes evolved into a plant, or an Ascidian, or a worm, a lobster, a fish, a reptile, bird or mammal, we leave the crystal a long way behind it. Thousands of new eventualities have to be provided for, and each of these eventualities must be an act of special creation. The physical laws which we see with admiration and wonder in the sidereal universe, and the formation of a crystal, are superseded by other laws, which again beget others which have no manner of connection with those which have preceded them. You cannot get on a step without evoking acts of special creation to assist you. Surely it would be no more miraculous to create such organisms at once according to the necessities which the great scheme of the Creator demands?

4 and 5. 'Special creation is worthless as not supplying an intellectual need nor a moral want.'

Such an argument as this can only be acceptable to those who leave the operation of a higher intelligence out of the question; for, surely there can be nothing more calculated to exalt the intellect or strengthen the moral sense than a contemplation of those special acts of creation by which the proof of such higher intelligence is rendered indisputable—especially in the adaptation of living things to the purposes of their existence. I shall have many opportunities of enlarging upon this subject in the course of the work.

Under this head, however, Mr. Spencer notices points which demand an immediate answer.[1]

He asks, 'Why at present is the earth largely peopled by creatures which inflict on each other, and on themselves, so much suffering?' Why 'the pain-inflicting appliances and instincts with which animals are endowed?' And he refers to the evidences of the geological record, and shows us that myriads of ages before the advent of man upon the earth animals were endowed with such weapons; and then he asks, 'How are we to explain this devouring of the weak by the strong? How does it happen that in almost every species the majority die by starvation or violence before arriving at maturity? Whoever contends that each kind of animal was specially designed, must assert either that there was a deliberate intention on the part of the Creator to produce these results, or that there was an inability to prevent them. Which alternative does he prefer? To cast an imputation on the Divine character, or assert a limitation of the Divine power?' And then, under this head, Mr. Spencer examines the facts more closely.

[1] *Op. cit.*

'What shall we say when we see the inferior destroying the superior? What shall we say on discovering elaborate appliances for securing the prosperity of organisms incapable of feeling, at the expense of misery to organisms capable of happiness?'

He then quotes in proof, the various parasites which live upon the different animals in creation—'often elaborate contrivances were combined to ensure the continuance of their respective races; and to make it impossible for the successive generations of men to avoid being preyed upon by them.'

Well! it is the old, old story. *We cannot answer these questions.* They are among the mysteries which cloud the very small proportionate dark side of creation. But Mr. Spencer asks all these questions with the most inimitable *naïveté*, utterly unconscious all the while that he does not remove the difficulty by substituting evolution for special creation. As has been remarked by Flourens, there can only be two modes of creation—either by spontaneous generation or by the hand of God. It is quite true that in even these latter days the doctrine of spontaneous generation is believed in by many. But then if Darwinians and evolutionists hold this doctrine they must give up such bald theology as that which they frequently express—and which is, indeed, strongly put forward by Darwin himself—that they can see no difference between creation by law and special creation, so far as the power, the goodness, and the wisdom of the Creator is concerned. Mr. Spencer may have more modified views upon the question, but his arguments apply with equal force to every position except that which rejects all theistical belief.

Upon this subject we—whether we belong to the scientific world or not—must have no mystification. It would be the meanest of mean subterfuges to attack religious belief, either upon natural or revealed evidences, from a standing-point in which the arguer had himself no resting-place; and I am very far from believing that such is the case with Mr. Spencer.

But if there are circumstances in the economy of nature which are difficult to understand, and which it would be presumptuous in an imperfect intellect like that of man to attempt to interpret, how much is there of direct and unmistakeable evidence of the goodness and wisdom and benevolence of the Deity!

The greatest enemy which man has on earth is himself and his own evil passions. Of what avail then is it to talk of an instrument of self-protection here, or of one aggressive there, in the animal world, as a proof of malevolence, as is done by Mr. Spencer in the following passage: 'And if infinite goodness was to be demonstrated, then not only do the provisions of organic structure, if they are specially devised, fail to demonstrate it; but there is an enormous mass of them which imply malevolence rather than benevolence.'[1]

Of what avail is it to carry us into a long detail of

[1] *Op. cit.* vol. i. p. 345.

the existence of intestinal worms, and other parasites, which, in nine times out of ten, are owing to man's unclean habits or mode of feeding? Of what avail is it to use such arguments as these against the myriads of examples which can be adduced of the goodness and benevolence of the Creator? Was it the evolution of matter that ordained the system of the universe? that gave to the living world the means of living? to man his intellect and reason, and the sublime aspirations he feels when he contemplates and studies the external evidences of an eternity of wisdom and power? Is there nothing good or great in the structure of the living body, with its ten thousand dependencies upon those things which nothing but forethought and Infinite Wisdom could have provided?

Is there nothing in man's position as the lord of all nature—the physical representative on earth of that great spiritual Being by whom and for whom that earth was formed?

Is there nothing in the God-like intellect which over the world of matter reigns supreme? Is there nothing in our social standing, our moral sense, our affections, our happiness, our comforts, our past memories and our future hopes, for which we have to thank and bless Him by whom we were created?

I will not dwell upon the subject—I should not even have recurred to it again, but it is imperative upon me to show what Mr. Spencer offers as a substitute for special creation.

CHAPTER VI.

THE PHYSICO-PSYCHICAL ARGUMENT CONTINUED.

Mr. Spencer's substitute for special creation.—Its hollowness and unsoundness pointed out.—Evolution not cognate with potentiality.—The argument from classification.—Its want of plausibility.—Language in man not correlated with that of animals.—The argument from Embryology.—The argument from Morphology.—Segmentation.—Agassiz.—His beautiful teleological views.—General and special homologies.—The argument from Distribution.—Van Baer's illustration.—Anabas scandens.—Astronomers.—Geology dead against Mr. Spencer.

I SHALL notice Mr. Herbert Spencer's substitute for special creation under the several heads adopted by him.

1. *The general aspects of the Evolution hypothesis.*—This has already been discussed. But it is necessary to notice Mr. Spencer's contrast between the two hypotheses, as he calls them. This he does, as might be anticipated, entirely in favour of evolution. Thus, 'the supposition that races of organisms have been evolved is credited by its origin.' By this he means that while the idea of special creation was 'a conception suggested and accepted when mankind were profoundly ignorant,' that of evolution was 'born in times of comparative enlightenment.' If this means anything it is the assertion that the writings of all philosophy

in past ages go for nothing when opposed to the grand truths enunciated by Darwin, Huxley, Hooker, and Spencer.

Most assuredly, if there is even 'a soul of truth' in such a statement, it is, at all events, put before us with consummate coolness. We must have very much better evidence against special creation than is contained in the works of Mr. Darwin or the 'Principles' of Mr. Spencer before the scientific or learned world will fall in with such a conclusion.

Listen to the style of argument used in the 'Principles':—'If a single cell, under appropriate conditions, becomes a man in the space of a few years, there can surely be no difficulty in understanding how, under appropriate conditions, a cell may, in the course of untold millions of years, give origin to the human race.'

Plausible and apparently true as is this illustration, it requires no great amount of reflection to show its unsoundness. It may, however, be taken as a sample of the kind of argument used to account for the evolution hypothesis. An embryonic human cell will of course be developed into a grown-up man in due course. But it is one of the grand characteristics of that cell that it will become a human being, and nothing else: and it can only do this either from an inherent potentiality or by the continued direction and supervision of a supernatural power. I am willing, for the sake of argument, to adopt the former alternative, for in either case I believe the power to be owing to the continued operation of a First Cause. Well, I follow this cell till it becomes a man, and there ends its physical history. The man does not become developed into anything else; he simply lives to three score years and ten and then dies, and his physical structure becomes dust of the earth. In order to perpetuate the race, I must have *two* cells—one of which grows up into a man and the other into a woman. How is this done by evolution from Mr. Spencer's single cell? On this ground, then, his proposition is 'unthinkable.' Again, when he talks of the cell, in the course of untold millions of years, giving origin to the human race, he, of course, means by his evolution hypothesis—his 'integration of matter, and passage from the homogeneous to the heterogeneous, with corresponding diminution of motion.' This proposition is equally unthinkable, for we have nothing to compare with a potentially endowed organic cell being developed into a species different from its parent.

2. *The argument from Classification.*—Here again we have the old illustration, made so much of to no purpose by Mr. Darwin, of the analogy from the 'evolution' of languages.

But, really, this argument is not worth the paper on which it is written. It has nothing whatever to do with the different phases of organic structural development. But the evolutionist ought to be consistent, and carry his views farther than he does.

If man has been evolved from animals, he is correlated with them. If so, his language ought to be correlated with theirs, and we ought to find the chirp of the bird—the braying of the ass—the bark of the dog—the howl of the monkey traceable to a common origin, and man's language from theirs! But we have, unfortunately for Mr. Spencer, an ugly answer to the argument that human reason and human intellect stop the way. And we have man's organs of speech specially adapted to give utterance to his intellectual thoughts. The monkey, so like us in structural organisation and so intelligent in many of his actions, has never been taught to utter so much of the human language as a parrot. He is not dumb, for he can howl and squeak, and chatter and bark, but he never approaches human language. He can be taught many things human-like, but never to speak. And this is a very strong argument against the human speech being correlative with that of animals.

Human language is the means by which intellectual man expresses his thoughts. The organisation of the brain and organs of voice are similar in all men. There can be nothing wonderful then in the fact, supposing it to be true, that, in the earlier ages of man's existence on earth, he should have spoken one language, and that when he separated into different groups which became isolated in different climates and under different physical conditions—the mode of expressing his thoughts should have been symbolically different. The analogy between such an evolution and that of animals falls to the ground at once.

With regard to the classification of animals by man, it is purely arbitrary. One man adopts habit, another structure, another unites both, and we have systems of classification proposed almost every year. Mr. Huxley classifies birds according to the form of the palate bone. He divides the human race—or, as he says, we may call them, if we like, species—into four great groups, by the colour of the skin and eyes and the character of the hair. He moulds, in fact, his classification upon his theory of evolution, and therefore it would be monstrous to take his classification as a proof of his theory!

3. *The argument from Embryology* I have already dealt with as far as it is necessary in a work like the present.

4. *The argument from Morphology.*—Mr. Spencer begins this argument by stating that all insects and crustacea have twenty segments in their body, and then he remarks that 'to say the Creator followed this pattern throughout, merely for the purpose of maintaining the pattern, is to assign a motive which, if avowed by a human being, we should call whimsical.'

Of course, no intelligent naturalist would be so silly as to give this irreverent and far-fetched explanation of a great natural law. The general reader will learn with astonishment, after looking over the above passage, that the basis of the great Cuverian system of classification is the uniformity of plan observed in the four great divisions or sub-kingdoms of nature. The lowest, or Protozoa and Cœlenterata, are formed upon the plan of radiation, that is, the different parts of the animal radiate from a common centre. The Mollusca are created upon a plan totally distinct—soft bodies protected by shells and formed symmetrically. The plan of the Annulosa, including the lobster and insects alluded to by Mr. Spencer, is that of annulation—the body is more or less made up of annular segments or rings; hence the name. These segments in insects are perforated with holes for the purposes of respiration, while in the lobster that function is performed by gills. What if the same number of segments occur in the two families? Go into other families, the Annelida and the Myriapoda, and you will find the segments vary greatly from each other and from the Crustacea and the Insecta. Made upon the same plan, nothing can exceed the differences in form, habit, and habitats than those of various families from each other. The Vertebrata again are formed upon the plan of a spinal column made up of numbers of separate bones called vertebræ. But these vary in number from some 20 or 30 in Mammalia to 300 or 330 in reptiles!

It is not, therefore, to 'keep up a pattern,' as Mr. Spencer remarks, that these similarities exist. They are the expressions of the thoughts of the Deity. When comparing the beautiful diversity of form, moulded upon the same plan, in the Radiata, Agassiz thus expresses himself:—

'Only a thinking power could devise such a plan; it is not the *result of chance.* Such close relations under the same circumstances show a power to overcome physical and local influences. For these animals live side by side on the same rock. You cannot visit a single coral reef without finding on its surface thousands of star-fishes, hundreds of jelly-fishes almost as soft as the water, polyps, and corals innumerable, all in the same element and locality, and therefore under the same influences. How can they exist there side by side, *except by a higher power than the forces which are active in the sheet of water?* Is there not some other cause for their diversity than the influence of heat, light, moisture, and soil combined? One combination certainly cannot produce such diverse results, such different structures upon the same plan. It must be mind acting among these elements, making them subservient to its purpose, and not the elements themselves working out higher combinations of structure.'[1]

Mr. Spencer, going from general homologies to the 'special homologies between different organs of the same animals,' adduces in favour of his evolution hypothesis the facts that (*a*) snakes, which move sinuously through and over plants, have evolved to them a segmented bony axis. (*b*) In higher Vertebrata the 'mechanical action and reaction demand that while

[1] *Structure of Animal Life*, pp. 13–14.

some parts of the vertebral axis shall be flexible, other parts shall be inflexible.'

Therefore 'In mammals and birds there is a sacrum in which the vertebræ are confluent.' And then he asks triumphantly, 'Why, if the skeleton of each species was separately contrived, was this bony mass made by soldering together a number of vertebræ like those forming the rest of the column, instead of being made out of a single piece?'

If Mr. Spencer could not see any thoughtful design and adaptation in the form of the snake to the circumstances of its existence, it may readily be imagined that he would be in the same difficulty with regard to the anchylosed vertebræ. But the latter is more inexcusable, because it displays an inattention to the law, that a bone formed of several separate pieces will resist the rude shocks to which the body would be subject better than though it had been carved out of a single piece; which latter also, for the above reason, would be more liable to fracture!

5. *The argument from Distribution.*—'Water being the medium in which the lowest living forms exist, it is implied that the earth and the air have been colonised from the water.'

Of course they have, if the theory of evolution be true. Mr. Spencer is, however, aware of the immense difficulties he has to contend with here, and quite heroically quotes the following satirical passage from D. Van Baer:—

'A fish swimming towards the shore, desires to take a walk, but finds his fins useless. They diminish in breadth for want of use, and at the same time elongate. This goes on with children and grandchildren for a few millions of years, and at last who can be astonished that the fins become feet. It is still more natural that the fish in the meadow, finding no water, should gasp after air, thereby, in a like period of time, developing lungs; the only difficulty being that in the meanwhile a few generations must manage without breathing at all.'—P. 392.

It would have been consistent in Mr. Spencer, after quoting the above crushing passage, to have given up his evolution hypothesis. But he does no such thing. Admitting that transmutation as thus drawn is untenable, he yet consoles himself with the reflection that there are fish which actually do 'take a walk;' and still more, one knowing fellow, far beyond his race, *Anabas scandens* by name, actually climbs up trees! Like Mr. Darwin's bear, which, by swimming about and catching flies, ultimately became a whale. I have no doubt that the evolutionist will make the most of the 'walking' and 'climbing' fish; and that we shall, before long, come across a fin evolving into a foot or a hand, and the swim-bladder being converted into lungs.

The *onus probandi* of such discoveries is fairly to be thrown upon Mr. Spencer and his disciples; but it is rather against his theory that up to this year of grace

1872 no single divergence of structure of a like nature has been discovered in the animal world; simply because it is an impossibility. Species are fixed, not transmutable.

Passing from the deductive to the inductive argument, Mr. Spencer does not improve his case. The astronomers are dead against him; they are so unkind as not to allow him time for his processes, as they prove that the sun has only existed some 500,000,000 of years! The geologist is still more cruel; no intermediate form or changing structural organism has the stone book hitherto revealed. 'Geology,' says Agassiz, 'shows that there has been no gradual transformation; but, on the contrary, that there has been the same diversity which we observe now *in all times.*

'We find all the different types of animals existed in the most ancient times. Representatives of the four great divisions—radiates, molluscs, articulates, and vertebrates—have always existed side by side.

'*These, therefore, could not have been derived from one another, for contemporaries cannot be each other's descendants.*'[1]

And with this quotation I will take leave of this part of the subject. Mr. St. George Mivart believes that the work of creation may be effected, under Divine guidance, by evolution.

I maintain that we have no proof of this, and that

[1] *Structure of Animal Life*, p. 84.

we are, in fact, profoundly ignorant of the *modus operandi* of creation. We know that the organic and inorganic worlds have been formed by a thoughtful, reasoning Being; but the 'how' or the 'why' are hidden among the mysteries of Omnipotence.

CHAPTER VII.

THE VARIATION AND NATURAL SELECTION ARGUMENT. THE HYPOTHESIS OF DARWIN AS SET FORTH BY HIMSELF AND PRINCIPAL SUPPORTERS.

Mr. Darwin's works.—'Animals and Plants under Domestication.'—Dogs.—The discoveries of M. Flourens fatal to Mr. Darwin's entire theory on this point.—Domestic cats.—The horse.—The ass.—Pigs.—Cattle.—Sheep.—Goats.—Rabbits on Porto Santo.—Reasons for their change in colour and size.—Domestic pigeons.—Their descent.—Erroneous deductions drawn from monstrosities.—The rock pigeon of Madeira.—Buffon on pigeon fanciers.—M. Flourens' comments.—Pigeon monstrosities not comparable with variations in nature.—Domestic fowls.—Other birds and plants treated by Mr. Darwin.

We now come to discuss the theory of Mr. Darwin upon his own ground.

Mr. Darwin is thoroughly in earnest, and carries out his principles with perfect fairness to their utmost limits.

I propose on the present occasion to pass in review his last two works, on 'Animals and Plants under Domestication,' and the 'Descent of Man, and Selection in Relation to Sex.'

The other works published by Mr. Darwin since 'The Origin of Species' are: 'The Fertilisation of Orchids,' an excellent and most interesting work; a paper on the 'Legitimate and Illegitimate Union between the two kinds of Primrose,' in the Journal of the Linnæan Society, vol. vi.; another paper on 'Dimorphism of the Flax Plant;' another on the 'Trimorphic Nature of the Common Loosestrife;' and another on the 'Habits and Movements of Climbing Plants,' in the same Journal, vols. vii. and viii.

I propose to summarise and comment upon the facts and theories contained in the two larger works first mentioned. In doing this I shall study conciseness, as most likely to be acceptable to the reader.

1. 'Animals and Plants under Domestication,' in two volumes, treats of the variations observed in such organisms, under the direct observation, supervision, and direction of man, and traces as far back as possible the history of each species.

(1.) Dogs.—'We shall probably never be able to ascertain their origin with certainty (p. 15). It is extremely improbable that every domestic breed has had its wild prototype' (ib.).

After going through the evidence upon which the latter opinion is grounded, Mr. Darwin admits, 'that at a period between four and five thousand years ago, various breeds, viz. pariah dogs, greyhounds, common hounds, mastiffs, house dogs, lap dogs, and turnspits, existed, more or less closely resembling our common brood.' Mr. Darwin gets over the difficulty to his theory offered by this candid admission, by falling back upon the discovery of 'flint tools embedded with the remains of extinct animals,' proving that man has existed for an incomparably longer period.'

Mr. Darwin's belief then rests upon another hypothesis, equally with his own not proven. He then enters into details to prove that all our domestic breeds of dogs have descended from the wolf, which evidence may be summarised thus:—

1. The resemblance between the North American wolves (*Canis lupus* var. *occidentalis*) and the domestic dogs of the Indians. (Richardson.)

2. Dr. Kane has often seen in his teams of sledge-dogs the oblique eye, the drooping tail, and scared look of the wolf.

3. They frequently cross with the wolves, and the Indians take the whelps of wolves to improve the breed of their dogs. (Kane.)

4. The Hare Indian dog, which differs in every respect from the Esquimaux dog, bears the same relation to the other American 'kind of wolf' (*Canis latrans*) that the Esquimaux dog does to the great grey wolf (*C. lupus*). (Richardson.)

5. In Florida, the black wolf-dog of the Indians differs in nothing from the wolves of that country, except in barking. (Bartram.)

6. Southern parts of New World. Columbus found two kind of dogs in the West Indies, and Fernandez three in Mexico.

7. Natives of Guiana have partially domesticated

two aboriginal species, which belong to a different type from the North American and European wolves.

8. In the Old World, some European dogs closely resemble the wolf, *e.g.* shepherd dog of Hungary. (Paget.)

9. Shepherd dogs in Italy *once* resembled wolves. (Columella.)

10. Several accounts have been given of dogs and wolves crossing naturally.

11. The Gauls used to tie their bitches in the woods that they might cross with wolves.

12. The European wolf differs from that of North America, and has been ranked as a distinct species. Same with the Indian wolf, which has been called a third species; and the Indian pariah dogs of certain districts of India resemble the Indian wolf. (Blyth, as 'Zoophilus,' in 'India Sporting Review.')

Similar instances are adduced to show the great resemblance between the dog and the jackal, and the dog and the fox, in those countries where these animals dwell; and Mr. Darwin comes to the conclusion that all known varieties of dogs have arisen from 'two good species of wolf, *Canis lupus* and *Canis latrans*, and from two or three doubtful species of wolves in Europe, India, and North Africa; from at least one canine species in South America; from several races or species of jackals, and perhaps from one or more extinct species' (vol. i. p. 26).

The experiments of the late M. Flourens, however, negative these suppositions of Mr. Darwin. M. Flourens was a member of the Royal Academy of France, and perpetual secretary to the Académie des Sciences. He was fellow or member of all the learned societies of Europe, and his name stands second to none among the naturalists of the age.

In his 'Examen du Livre de M. Darwin,' 1864—a work from which I have devoted a chapter of extracts in the Appendix—M. Flourens, who has had immense experience in the crossing of animals at the Jardin des Plantes, declares his solemn conviction, over and over again repeated, that 'species are fixed' and not transmutable. His experiments led him to the conclusion, previously arrived at by Buffon, that the 'character of species is continued fecundity,' and the 'character of the genus is limited fecundity.'

As an illustration of these laws take the following instance. The jackal and the dog belong to the same genus, but they are different species, and the same is true of the wolf and the dog. When the jackal and dog are crossed with each other, the produce is equally jackal and dog in their external characters. If this produce is crossed with one of the two species, say the dog, it is found that the mongrel produced is less savage, and more like the dog than the jackal; the third generation is still more like the dog, and in the fourth generation it is pure dog. And this fourth generation can never be exceeded; i.e. the return to the natural species never exceeds the fourth generation—

> Naturam expellas furca, tamen usque recurret.

If, on the contrary, the produce of the first cross is crossed with the jackal, then invariably is the jackal pure at the end of the fourth generation. But the produce of the union of jackal and dog are between themselves absolutely infertile, as is the produce of the horse and the ass, and as is that between the wolf and the dog, and the ram and the goat. *They never establish an intermediate species.*

Surely such facts as these—never contradicted or even noticed by Mr. Darwin—are absolutely fatal to his whole theory.

Domestic cats next occupy Mr. Darwin's attention; but he adds nothing to the facts already known, and is unable to say whether they have 'descended from several distinct species, or have only been modified by occasional crosses.'

The horse is referred back as a species to the 'stone age' of man's existence; and as he cannot prove that he has varied during that immense period more than may be seen in our domestic breeds, which variation is about equal to that between the working and idle classes of society, I think we may fairly give a verdict here that nothing has been added to strengthen the hypothesis of Mr. Darwin.

The domestic ass, Mr. Darwin says, is descended from the *Asinus tæniopus* of Abyssinia. He indulges in some interesting remarks about the variation of the shoulder-stripe.

Pigs, cattle, sheep, goats occupy Chapter III. Pigs, I am willing to admit, have descended from *Sus scrofa,* the wild boar. Whether a second and *unknown* origin may be admitted, on the authority of Nathusius, is, I think, very probable; for the osteological changes which he himself tells us may be produced by feeding, and non-use of organs, is quite sufficient to account for his 'unknown ancestor.' Why the domestic boar of England should have three more vertebræ than the Chinese domestic, the wild boar, and the French domestic boar, as well as two more than the African female, depends, doubtless, upon either the anchylosis of some of the latter, or they may be referred, if it is thought more probable, to the second species, which have been the originals of our domestic breeds.

Domestic cattle, Mr. Darwin thinks, like our pigs and dogs, have descended, as we see them in our broad pastures, from more than one wild form. The chapters and facts are interesting, but they do not strengthen the theory.

Sheep.—The origin of the domestic sheep is a more difficult question, from the variety of opinions held by different writers upon the subject. Mr. Darwin adds nothing new to it.

Goats, Mr. Darwin believes with Brandt, are 'all descended from the *Capra ægagrus* of the mountains of Asia, possibly mingled with the allied Indian species *C. Falconeri* of India.'

Rabbits.—There need not be any difficulty in admitting that all the varieties of our domestic rabbit have descended from the common wild species, though Professor Gervais holds a contrary opinion, upon structural grounds. Mr. Darwin admits that, 'when variously coloured rabbits are set free in Europe, and are thus placed under their natural conditions, they generally revert to the original grey colour.' He thinks it very important that rabbits turned out on the island of Porto Santo, near Madeira, in 1420, should have so far altered their characters as to be in danger of being formed by our systematisers into a new species. The most wonderful part of the story is, that this rabbit escaped the infliction which a certain class of naturalists called 'species-makers' are always on the look-out for the opportunity of effecting; and the grounds for such new species would have been their much reduced size, their reddish colour above, and grey beneath, with neither tail nor ears tipped with black. But supposing it were proved (it is only surmised) that the original rabbits turned down in Porto Santo 440 years ago were the common wild species, it must be borne in mind that these rabbits soon increased to such an extent as to cause the *abandonment of the settlement.* Well, everyone knows that short commons will stunt a race of anything, vegetable or animal; and we all know that, combined with want of food, exposure to a hot sun would alter the colour of the creature's fur. Suppose they had been white men instead of rabbits, placed under like conditions, there can be no doubt but that the race would have degenerated in size, and become permanently discoloured by the sun.

Mr. Darwin gives us a good many figures, showing the difference in size of vertebræ and other bones, to illustrate this foregone conclusion. If he will collect the vertebræ, skulls, and bones of different classes of human beings in England alone, he will find them vary more than in the rabbit.

The chapters (V. and VI.) on *Domestic Pigeons* are the most elaborate in the work. Mr. Darwin divides pigeons into eleven different races and many sub-races, all of which, he says, have originated from the common Wild Rock pigeon, *Columba livia*; and he illustrates the text with good figures of the different races—viz., English Pouter, English Carrier, English Barb, Fantail, African Owl, Short-faced Tumbler—all capital likenesses.

He has also given figures of different sized skulls and jaw-bones, scapulæ, and clavicles, differing just as much from each other as the same bones in different sized Englishmen would do; and nothing more. He has adduced no proof, nor even the shadow of it, that these creatures ever varied in a direction either from or to a pigeon; *they are, in fact, monstrosities.*

A few weeks ago I was looking over the pigeons of an amateur in this town, and I asked him why he did not let the Short-beaked Tumblers fly out of doors. If I had asked him there and then for his purse, he could not have been more astonished. 'Let them fly, sir! surely you know what would happen?' I assured him that I was perfectly ignorant. With a smile of conscious superiority, my friend informed me that if he allowed them to fly, they would revert to a state of nature, and that in a few weeks the beautiful small beaks would be as long and as coarse as those of any other bird! Of course they would.

Even, in a state of nature, Mr. Darwin describes osteological differences in the same species subjected to the same influences:—

'In Madeira there is a rock pigeon which a few ornithologists have suspected to be distinct from *C. livia.* I have examined numerous specimens collected by Mr. E. V. Harcourt and Mr. Mason. They are rather smaller than the rock pigeon from the Shetland Islands, and their beaks are plainly thinner; *but the thickness of the beak varied in the several specimens. In plumage there is a remarkable diversity.*' (P. 184.)

'I have also received, through the kindness of Mr. Daniell, four living dovecot pigeons from Sierra Leone. In plumage some of them were identical with the rock pigeon; . . . others had a blue crop, and resembled *C. intermedia* of India; and some were so chequered as to be nearly black. *In these four birds the beak differed slightly in length.*' (P. 186.)

If this is true naturally, why make so much of it as the result of natural selection? It does not tend any more to transmutation than the difference between Englishmen's noses does.

With regard to the changes produced in pigeons by 'fanciers,' Buffon [1] has remarked, in his history of that bird:—

'The preservation of varieties and their multiplication depend upon the hand of man. He collects together from nature the individuals which most resemble each other, he separates them from the others, unites them together, and takes the same care of the varieties which are found among the numerous productions of their descendants; and, by continued attention, in time an infinity of new creatures, which nature by itself would never have produced, are created before our eyes—that is to say, brought to light. . . .

'The combination, succession, arrangement, re-union, or separation of beings, depends often upon the will of man, since he has the power to force nature by his combinations, and to fix her by his industry: from two single individuals which are produced as it were by accident, he will form a fixed and perpetual race, from which he will draw many other races which, without his skill, would never have seen to-day.'

Upon this Flourens remarks: 'These are the facts

[1] For Buffon's remarks upon the subject, see Appendix.

which Buffon saw and which everyone knows. Darwin has seen nothing more. He has only added to all this a metaphorical language which dazzles, and he imagines that "*natural selection*" which he gives to nature must have incommensurable effects (this is his own word) above the feeble power of man.'[1]

Mr. Darwin has, I think, wasted much valuable time in his efforts to show that these pigeon monstrosities are in any way comparable with the variations we see every day in nature. The facts are curious and interesting as researches which may be useful to the pigeon fancier, but, as facts likely to strengthen his hypothesis, their value is very slight.

Domestic fowls Mr. Darwin believes to have descended by independent and different roads from a single type.

He describes thirteen breeds or varieties of domestic fowl and seven sub-breeds. But whether these varieties have really originated from *Gallus Bankiva*, or jungle cock, as Mr. Darwin believes, or from several independent sources, as most breeders think, is left an undecided question, and it is one of really very little moment, as many of the domestic breeds of fowls are monstrosities produced by human skill just as we have seen with pigeons. The facts—even the altered bones—have little or no bearing upon the doctrine of evolution of species. The domestic fowl was 'introduced' into China 1400 years B.C. and into Europe

[1] See Appendix.

600 years B.C. The whole of this chapter is very interesting and worth reading as a history of the domestic fowl. It would answer no useful purpose to carry on this abstraction further. Chapter VIII. is devoted to ducks, geese, peacocks, turkeys, guinea-fowl, canary-bird, gold-fish, hive-bees, silk-moths; Chapter IX. to cultivated plants, cereal and culinary; Chapter X. to fruits, ornamental trees, and flowers; and Chapter XI. to bud variation, and on certain anomalous modes of reproduction and variation which are all most interesting as researches in natural history.

CHAPTER VIII.

THE VARIATION AND NATURAL SELECTION ARGUMENT CONTINUED.

Inheritance.—Pangenesis.—Various gemmule theories.—Buffon, Bonnet, Owen, Spencer.—Mr. Darwin's theory discussed at length.—Matter, its properties indicative of the limitation of human reason.—Häkel's similiarity of a speck of protoplasm and a human germ considered and disproved.—Illustrations given opposed to Häkel's view.—The diamond.—The protophyton.—Objection does not apply to 'Analogies' and 'Homologies.'—The human hand and paddle of whale.—General conclusions.

THE second volume of 'Animals and Plants under Domestication' is occupied in the further development of Mr. Darwin's hypothesis, and will, therefore, require a more extended notice.

The first three chapters are upon the subject of inheritance. And I cannot help observing *in limine* that I think Mr. Darwin has laboured with unnecessary minuteness to prove the foregone conclusion that a man is very often like his father both in person and disposition. To *account* for all we see and know however upon this subject is a very different matter, and in the end speculators are obliged of necessity to fall back upon some enormous guess like that of 'physiological units' or 'Pangenesis.'

The latter being an important item in Mr. Darwin's argument, I will discuss it before alluding to its application.

Mr. Darwin assumes that all 'cells before their conversion into passive material in the animal organism throw off minute granules or atoms which circulate freely throughout the system, and when supplied with proper nutriment multiply by self-division and ultimately become developed into cells like those from which they were derived.'

These granules he calls 'gemmules,' and he supposes that they are transmitted from parent to offspring, and are generally developed in the generation which immediately succeeds, but are often transmitted in a *dormant* state during *many generations*, and are then developed. Their development is supposed to depend on their union with other partially developed cells or gemmules, which 'precede them in the regular course of growth.'

As it affects inheritance, Mr. Darwin applies the hypothesis thus. He takes Häkel's (the Professor of Comparative Anatomy at Jena) view of the development of the Protozoa. 'If we suppose a homogeneous gelatinous protozoon to vary and assume a reddish colour, a minute separated atom would naturally, as it grew to full size, retain the same colour, and we should have the simplest form of inheritance.' Now, let us carry on the supposition and apply it to the higher animals, say a pigeon or a man. Then, the formation of these gemmules in the pigeon or man would, like the minute atom of the protozoon, represent the organic genesis of a pigeon or a man; but, in the instance of the pigeon, they might remain dormant for ever so many thousands of years, and then develop from a monstrous variety to a veritable blue rock; or, in the case of man, they might remain dormant for an indefinite period, and if the individual had a wart on his cheek, they might a thousand years after develop into a man who would, like his ancestor, also have a wart upon his cheek. And thus would Mr. Darwin account for reversion or atavism, and also a great feature in his developmental hypothesis, viz. 'the important principle of inheritance at corresponding ages.'

The Rev. Mr. Berkely, in his inaugural address at Norwich, expressed his opinion that the doctrine would be thought too materialistic to meet with general approval; while Dr. Hooker said if it did not explain, it would correlate all phenomena.

Buffon, Bonnet, Owen, and Herbert Spencer have each of them enunciated a theory in some respects similar to that of Mr. Darwin. And just as Mr. Darwin's hypothesis of natural selection and progressive development is merely a modification of Lamarck's theory of development, so is the hypothesis of pangenesis a modification of the genetic speculations of the above great naturalists. Buffon believed in molecules existing in the food we swallow which were analogous to the various organs by which they were absorbed. Bonnet enunciated the theory of '*emboîtement*,' which implied that germs were included within germs in endless succession, preformed and ready for all succeeding generations. Professor Owen, in describing his theory of parthenogenesis, expressed a belief that derivative germ-cells remained unchanged in the body, and that such derivative germ-cells 'may commence and repeat the same processes of growth by imbibition, and of propagation by spontaneous fission as those to which itself owed its origin.' Mr. Darwin explains how this hypothesis differs from his own, inasmuch as 'my gemmules are supposed to be formed *quite independently of sexual concourse, by each separate cell or unit throughout the body, and to be merely aggregated within the reproductive organ.*'

Mr. Herbert Spencer, in his theory of physiological units, makes the sexual elements mere *carriers* of his units; the said units possessing polarity or affinity, being efficient agents in 'all forms of reproduction, and in the repairs of injuries.' But here Mr. Darwin differs again, inasmuch as a certain number of gemmules, or mass of them, 'are requisite for the development of each cell or part.' And besides, Mr. Spencer's theory does not provide for 'reversion,' which we have seen Mr. Darwin's gemmules are presumed to do most effectively.

The reader will be kind enough to bear in mind that all these theories are mere guesses—by their very nature they are insusceptible of proof in the present state of science; and the glaring improbability of gemmules being propagated in an inactive condition for thousands of years, and all at once, by a chance cross, brought into vital activity, and becoming developed into attributes or parts or wholes of living things, will not, I think, very strongly recommend itself to thinking men.

And yet, there may be what Mr. Spencer would call a 'soul of truth' in these theories, which has yet to be definitely proved. Kept within proper limits, there is nothing contrary to known physiological facts in dormant germs. Cases are on record, and indeed have come within the experience of most medical men, of the virus of hydrophobia or scarlet fever remaining dormant for six, twelve, or eighteen months. A very well authenticated case is recorded of scarlet fever being produced by simply wearing the cloak of a person who had been covered with it during that disease, and the germ in this case did not cause scarlet fever till fifteen months afterwards. Here is an instance at once of dormant germs of a size too minute for the mind to realise. Equally authentic cases, as everyone knows, are on record about hydrophobia. Again, how small must be the germs by which constitutional diseases are conveyed from father to child. The difficulty in Mr. Darwin's theory is the immense time which he gives to the dormancy of his gemmules, as in the fancy pigeon sporting out like its assumed ancestor of remote times.

And yet, how are we to account for this reversion or atavism? It is much more easy to object to any theory, than to propose one more plausible. There are strong arguments in favour of some of the phenomena of inheritance not being of a direct nature at all. For instance, a medical man, who wrote cleverly and well a year or two ago in one of our medical periodicals, held the doctrine that the consequences which every medical man witnesses as the result of too close a relationship in marriage were not due to the relationship, but rather that, being related, both father and mother were equally situated as to any constitutional taint, and that by their union they intensified this proclivity in their offspring. In such a case the gemmule theory can be understood to have much plausibility. But the weight of evidence is strongly opposed to the view taken by this writer, as innumerable instances are known where both parents were perfectly healthy, and free from any known taint of constitutional disease, and yet, being closely related by blood to each other, their offspring were consumptive, or idiotic, or deformed. In this case the gemmule theory is altogether inefficient to explain the cause, and we are thrown back upon the belief that both father and mother conjointly have the faculty of forming a being like themselves, which shall be more or less perfect according to the relationship between them, and their own freedom from or possession of *the power of healthy self-organisation.* This power is, in all probability, similar to that with which we know the ultimate cell is endowed of 'selecting'—the elements necessary to form the flinty coat of the straw of wheat—or the liver, heart, lungs, brain, muscles, bone, and skin of animals. Mr. Spencer says that this is owing to the polarity or affinity of physiological units; Mr. Darwin, of minute gemmules; but that the power *cannot* be of a physical nature is proved by the fact that the qualities of *mind*, which is immaterial, are as strongly inherited as those of matter.

This power of selection in the ultimate cell of living things is one of the attributes of life, and not due to polarity, as in the crystal. The crystal has a greater affinity for one kind of matter than another in a solution, and that matter is attracted to it; but the selection of the living cell in forming one organ, as the liver, has reference to *a number of other important organs connected with it.* The crystal is formed by simple attractive segregation of atoms, the living thing by the consentaneous adaptation and co-operation of influences and modes of organisation totally different in themselves, but having reference to one perfect whole. Thus the liver is not formed by the selecting liver cell in reference to itself as liver only, but with perfect and indispensable co-adaptation to heart, lungs, kidneys, &c.

Again, physiological units or gemmules may have some plausibility as agents of inheritance, so far as the physical part of the body is concerned; but there is a 'spiritual body' to be thought of as well. There is the reasoning mind; and granted that this may be treated of as distinct from the superadded immortal soul, it cannot be treated of as matter.

It is quite true that the *material* brain is the organ of the *immaterial* mind. It is the complex machine which has the immaterial attributes of thought and sensation. It is the preordained and designed instrument by which the immaterial spirit regulates the economy of life. Now, this mind is as much inherited in its phases and character as the physical frame itself in its peculiarities and abnormities. And here the gemmule theory fails altogether. It is no answer to say that the brain, which is the organ of the mind, may be altered in its atomic character by these gemmules so as to obey the mental influence incorrectly, and thus exhibit the inherited peculiarity of mind. Such an answer is inadmissible on at least two distinct grounds: 1. Take six children, the offspring of the same parents, and you will find frequently that they all differ in disposition, in mental power, and in the presence or absence of some peculiarity observable in one or both of their parents. According to the gemmule theory, different sets of gemmules inherited from the parents have become actively developed in each of these children. Again, each of these children marry, and their offspring show different mental qualifications from their parents, and probably nine out of ten of them are like in this respect either parent or grandparent, and so on *ad infinitum*, which reduces the gemmule theory to an absurdity. Again, 2. The child may inherit the bad mental qualities of its father, but by control and strict discipline he can entirely alter and change their character; of which every day's experience presents us with examples. What becomes of the gemmule theory here? It is simply again reduced to an absurdity.

It is quite true that in talking of these 'gemmules' Mr. Darwin means matter so small in its atom as to be quite incomprehensible to human reason. For instance, the material element, transmitted in the form of 'gemmules,' must be limited to a minute portion of a spermatozoon so small itself that it can only be seen by the higher powers of the microscope. These 'gemmules' are supposed to remain inactive, and not to increase in size or number until they are destined to reappear in the adult future descendant. In the line of the pigeon we may assume we have direct evidence of their having existed, in the monstrous form we see them as fancy birds now, for 2,400 or 2,500 years. And as the pigeon breeds three or four times a year or oftener, this minute portion of a minute microscopical spermatozoon must have remained in active form more than 2,400 years, and have been directed by a chance shot into the fecundating spermatozoon of some 6,000 or 7,000 pigeons in succession, and then appear, like the blue feather in the wing of the bird's remote ancestor, the blue rock. All this would be very interesting in a fairy tale, but it lacks those elements which the inexorable rules of scientific investigation require to make it even probable. The matter which constitutes these gemmules must be so minute as to be beyond the power of the human intellect to realise or comprehend. In its relation to the human mind, indeed, it is, to all intents and purposes, immaterial; and a question rises up in one's thoughts whether, with the exception of a logical dogma, there really is any sharp line of division between the material and the immaterial.

The great unthinkable difficulty of the ultimate indivisibility of matter is at once got rid of, if we can imagine the said matter to pass into ether by gradations so minute as to render the actual transition for ever indefinable. By the adoption of such an hypothesis Mr. Darwin's doctrine of pangenesis would at least be removed out of the line of objection to which Mr. Berkely pointed out it was liable.

I do not wish to suggest any illogical hypothesis upon the subject, but as the ultimate indivisibility of matter is a problem beyond the power of the human intellect to solve, surely it is better to adopt a theory which makes matter, matter, so long as it remains within the domain of thought, and ether when it goes beyond it. Surely this is as plausible as the theory that matter is but a form of motion. But I am afraid such an hypothesis would not satisfy the evolutionists of the Spencer school. Matter which is immaterial would be too paradoxical for those who will build up the great fabric of nature by the operation of physical laws upon the processes of vitality.

To revert, however, to Häkel's analogy between the germ of a homogeneous, gelatinous protozoon, and that which afterwards becomes a man. Mr. Darwin applies the analogy to inheritance, but really the analogy is altogether unsound. The simple globule of sarcode which becomes developed into the simply organised protozoon—say the amœba—is as different from the small globule of matter which becomes developed into the man, as they are after each development has taken place. To the naked eye they may have all physical characters alike—and this shows the utter fallacy of the mode of reasoning from things apparently alike—but each globule is in fact *endowed* with a structure entirely different. This structure, though invisible with the highest power of the microscope, has the *power* of, in one case, being simply expanded or enlarged into a shapeless thing called an amœba, which has neither stomach, nor mouth, nor intestines, nor liver, heart, lungs, kidneys, muscles, bones or brain; and, in the other, of being developed with all these and more organs, and having at the same time reason, consciousness, and an immortal spirit! Surely it is trifling with science to call these two primitive globules alike because the eye cannot penetrate beneath their external characteristics. And this is really a very important point; for there is nothing upon which the evolutionist or the Darwinian relies more strongly than the similarity of the embryos of different animals in the scale at different periods of their existence, as we have seen before and shall have occasion to allude to again. In the meantime let me adduce one or two illustrations to prove my position.

Take a diamond and a piece of the finest rock crystal. They are each formed by the affinity of particles of matter to each other. How exactly alike they appear! and yet how dissimilar are they in physical structure and chemical composition! The one thing that we do find common between them is, that they are formed on the same plan. Show these similar crystals to an expert in precious stones and he will laugh at you for calling them similar. His eye, experienced in such matters, detects the difference in a moment. Such is the plan of inorganic life. If we examine the ultimate cells of plants, such, for instance, as those which select from the sap the flint for the wheat-stem, with those which take away the carbonate of lime for the rhododendron, or the potash and lime for the sunflower,[1] we shall find the protophyton, as it is termed, exactly of the same shape and appearance in each. An ignorant man will call them similar things. An educated man, who knows and can realise the difference between the elastic wheat-stem, the woody rhododendron, and the thick, fleshy sunflower, will at once mentally recognise and acknowledge an immense difference between the three cells he is examining.

[1] Bree's *Lower Forms of Life*, p. 11.

Again, let the enquirer go into the animal world and examine the protozoon, or ultimate animal cell, with the protophyton, or ultimate vegetable cell, and for the life of him he can distinguish no difference;[1] if he is ignorant, he will call them alike. If he is able to understand the difference between an oak-tree and a man, he will at once allow their essential difference. And the same argument holds good with all the different and varied forms of animal life, and the same mode of reasoning will show the utter fallacy and error of calling structures so essentially different alike, and founding upon such likenesses important biological laws, even up to the evolution of species. This objection does not apply to what are called 'analogies' and 'homologies,' although I think these anatomical elements are sometimes too sharply defined. The hand of man is homologous with the paddle of the whale—that is to say, it is the organ formed by Creative Wisdom to perform a certain series of complex functions, the most elaborate and most beautiful which the human mind is capable of conceiving. If a man jumps into the water, *then only* the hand is used in the same way as the whale's paddle. But while the hand of man is useful in its exceptional office of swimming, the paddle of the whale would be useless for any other purpose. Therefore we observe in the latter that the carpal or wrist-bones are mere ossicles imbedded in cartilage; so that the fingers do not, like

[1] *Op. cit.* p. 2.

those of the hand, move upon the wrist-bones, but upon the shoulder-bone or scapula. But there are other bones—the radius, ulna, and humerus, between the wrist and the shoulder—and these bones are said to be homologous with similar bones in the human arm; and the evolutionist points out the apparently useless carpal ossicles, and exclaims: Here are rudimentary parts useless in the whale, showing a community of structure in the mammalian series, which can only be explained upon a theory of a common origin of such structures, and arrested development of parts, showing, at certain periods of mammalian history, a diversion from functions then performed, and structures then permanently existing, to altered functions and rudimentary parts, as you now see them in the whale's wrist.

But let us look for a moment at the skeleton of the paddle of the whale in its totality. Could any structure be devised more perfectly or more beautifully adapted as the framework of a great oar to move an enormous carcase through the water? There are the five fingers formed of various phalanges and connected with each other by cartilage, so as to give them pliancy without the mobility of joints; there is the great mass of cartilage of the wrist, strengthened on its part with bony masses, homologous with our carpal bones; there are, upon this mass, the strong radius and more feeble ulna, and above them the short, strong humerus, with its ball-and-socket joint, in the glenoid cavity of the scapula. And when the framework is provided with muscles and covered with skin, it then forms an instrument of locomotion perfect in its kind, and unsurpassed even by the totally different and more complex hand and arm of man. And are we, because we cannot comprehend *how* creation was effected, to seize upon the Master Workman's unity of adaptation and simplicity of means, by which great ends are attained, as a proof that an organic being was merely evolved from another by means of physical forces, and the chance operations of variation, natural selection, and struggle for existence?

CHAPTER IX.

THE VARIATION AND NATURAL SELECTION ARGUMENT CONTINUED.

Crossing.—Its effects in modifying or producing new races.—Selection by man.—Causes of variability considered.—Use and disuse.—Changed habits.—Acclimatisation, and Spencer's view of use and disuse.—Why are the blacksmith's muscles of arm developed inordinately?—Spencer's view of the action of wind in increasing rising of sap refuted by Darwin.—Hard palms and soles of feet of fœtuses in utero.—Robert Knox upon use and disuse.—Acquired deformities not congenital nor hereditary.—Chinese foot as evidence.—Nathusius.—His doctrine of use and disuse.—The horse's foot.—Mr. Darwin's opinion that such a structure was assisted by natural selection refuted.—The horse in time.—Proof of final causes.

The fifteenth and three following chapters are occupied with most interesting details of 'Crossing,' and its effects in modifying old or producing new races. Mr. Darwin's opinion is that all, or almost all, organised beings occasionally cross. This 'crossing' simply refers to that which prevents interbreeding between near relations, the evil and deteriorating effects of which is well known. It is a law of nature 'that organic beings shall not fertilise themselves for perpetuity,' and in support of this Mr. Darwin quotes Kölreuter, who, when treating of the Malvaceæ, says that they are always impregnated by some other species, and adds, 'Nature does nothing in vain;'

which of course meets with a mild remonstrance from Mr. Darwin, who has 'rudimentary and useless organs' in his mind's eye. Hybrids are treated of in chapter nineteen. This is a very important part of Mr. Darwin's subject, and one of the great difficulties against which he ought to contend. I have thought it advisable to translate in the Appendix a portion of the work of M. Flourens, 'Examen du Livre de M. Darwin sur l'Origine des Espèces,' in which this subject is fully gone into. Mr. Darwin's views in the present do not materially differ from those in the former work, of which that of M. Flourens is a criticism; we will therefore pass this by for the present.

'Selection by Man' occupies chapters twenty and twenty-one, and we advise most attentive perusal of these chapters, as they show forcibly the wide difference, both in its nature and results of selection, between reasoning and unreasoning beings.

'The Causes of Variability' are dealt with in chapter twenty-two.

Mr. Darwin holds the doctrine that 'organic beings when subjected during several generations to any change whatever in their condition tend to vary; the kind of variation which ensues depending, in a far higher degree, on the nature or constitution of the being than on the nature of the changed conditions.'

This is, of course, one of the fundamental points in Mr. Darwin's theory of the formation of species.

That species will vary within certain limits according to conditions of existence, is a fact which may be called ultimate in science. It is disputed by nobody. But Mr. Darwin goes further; he says there is an inherent tendency in the constitution of the organism to vary, independent of, but modified by, its conditions; and it is this tendency, assisted by the lesser effect of the conditions—by the survival of the fittest—by correlation—and by inheritance—which produces the evolution of one species into another. The argument maintained by Mr. Darwin's opponents is, that neither inherent tendency nor the conditions of existence produce more variation than is limited; and that such variation reverts, after a time, back again to the species.

Passing over the causes of variability which refer to the conditions of existence, we are able, in chapter twenty-four, to infer what Mr. Darwin means by the 'nature of the constitution,' which is so potent in causing variation. Among the 'Laws of Variation' Mr. Darwin enunciates the following: 'Use and disuse, including changed habits and acclimatisation—arrests of development—correlated deviation—the cohesion of homologous parts—the variability of multiple parts—compensation of growth—the position of buds with respect to the axis of the plant—and, lastly, analogous variation.'

Let us examine some of these 'laws' which apparently throw light upon the 'nature of the constitution.'

1. *Use and Disuse.*—No person doubts the effects

of use and disuse in strengthening or weakening organs of the body. Mr. Darwin says that he has not seen any satisfactory explanation of this in works on physiology. I am afraid that this is in some degree caused by the fact that they give no aid to his theory. Mr. Herbert Spencer believes that when muscles are much used, an excess of nutritive matter exudes from the vessels. Why did he not say at once that the same rule which applies to the nutrition of the whole body applies to an individual muscle. Extra exertion demands extra nutriment, and so the body or the muscle requires extra food. Conversely, non-use of the muscle or body requires a diminution of nourishment. The blacksmith has the muscles of his arm more highly developed because the work he does requires it. This beautiful adaptation may appear cloudy to Mr. Darwin, but it is obvious enough to those who believe in the teleological argument. Mr. Spencer applies his exudation theory to trees, which he says have the ascent of their sap accelerated by being waved to and fro by the wind. But Mr. Darwin naively remarks that woody trees may be formed of hard tissue without being subjected to any movement, as in ivy.

Then Mr. Darwin refers to the hard palms and soles of feet of children in utero, and he asks the question whether such a thickening of the epidermis is not originally caused by hard work and such effects transmitted by inheritance. Here again the teleologist has no difficulty. He sees the wise preparation of structures for their destined use by a wise artificer, and he rejects as preposterous the theory of cause and effect propounded by Mr. Darwin.

Let us hear what the late Robert Knox, a man of great genius and knowledge, says upon the congenital transmission of acquired peculiarities of structure:—

'No deviations in form, even when they are produced, can ever become congenital or hereditary. Let the Chinese foot bear witness to this fact. For thousands of years has this non-progressive race been endeavouring to destroy the foot in Chinese women, without any success further than the modification of the individual; nor has the act of marriage permanently altered the form of woman.

Naturam expellas furca, tamen usque recurret

is the pithy and true saying of Horace, verified from all antiquity.'[1]

Mr. Darwin, however, rather believes in Nathusius' notion that 'the shortened legs and snout, form of the condyles of the occiput, and the position of the jaws with the upper canine teeth projecting in a most anomalous manner in front of the lower canines, may be attributed to those parts not having been fully exercised.' But then Mr. Darwin has a great theory to support; poor Robert Knox had only a scientific truth to vindicate. Again, Mr. Darwin applies the

[1] *Knox on Race*, p. 277.

'use' theory to the formation of the hoofs of quadrupeds; but then he thinks natural selection must also have assisted 'in the formation of structures of such obvious importance to the animal!'

Let us test this argument. The hoof of the horse is one of the most beautiful structures in nature, and its great beauty is in its evident adaptation to the animal, and its intimate connection with the parts of the foot it is destined to perfect, to co-operate with, and to protect. It has no analogy whatever with a part which has been hypertrophied by intermittent pressure, and therefore could never have been produced by 'use,' as stated by Mr. Darwin. This hoof is formed mechanically with reference to the speed, endurance and perfection of the motion of the animal. Let us briefly relate what the mechanical structure is. The hoof resembles a hollow cone *obliquely* truncated at its upper part, so that it may be highest and deepest in front and gradually diminish backwards. When it reaches what are termed the 'quarters'[1] of the foot it partly loses its conical shape, and becomes nearly upright; passing to the posterior of the foot as far as the 'frog,' it becomes suddenly inflected inwards, and pursuing this course towards the centre of the foot, it gradually diminishes and is finally lost in the 'sole' of the foot near the point of the 'frog,' thus forming a distinct internal wall which supports the under parts of

[1] See Treatises of Youatt, Coleman, and Bracy Clark.

the foot, and at the same time protects, by projecting boldly, the sole and the frog from undue pressure and injury against the ground. What 'principle' do we see operating here? Use? Variation? Survival of the fittest? Natural selection? No; the principle we observe is that of 'least action' of mechanical work done by reasoning forethought — of adaptation — of design. Let us follow the hoof a little further—let us look at its structure.

'Its inner surface is everywhere lined as it were with numerous elastic lamellæ that project internally, and are arranged in parallel lines proceeding downwards perpendicularly towards the front of the foot; these horny laminæ are at least five hundred in number, and afford, from the aggregate surface that they present, a very extensive superficies for the attachment of an equal number of similar processes derived from the vascular surface that covers the coffin-bone, *with which they interdigitate in such a way that the pressure to which the foot is subjected, which if concentrated upon a small surface would inevitably cause the destruction of living tissues, becomes so diffused as to produce no inconvenient results.*

'The horny lamellæ above alluded to when removed from the hoof have little or no elasticity when drawn in a longitudinal direction; but when drawn transversely they possess this quality in a very remarkable degree, more especially in resisting pressure applied in a direction outwards and downwards, to resist which the arrangement of their fibres is, on close examination, found to be *particularly adapted.*

'The whole horny roof, if unravelled by maceration or long-continued exposure, is found to be essentially composed of longitudinal corneous threads or hairs matted, and, as it were, strongly glued together—a structure pre-eminently *adapted* to combine all the *requirements of strength, elasticity, and toughness.*

'As it approaches the quarters and heels the horny helmet encasing the foot diminishes in its thickness as well as in height, affording, by this means, a degree of pliancy which here becomes as necessary as firmness and unyielding solidity were in the front of the organ; yet even here, by the doubling in of the hoof towards the sole, a strong horny margin is left *which is admirably adapted to receive the principal bearing of this part of the foot and to protect and defend the sole enclosed within its curvature.*'[1]

Now I say, such a structure as this bears evidence of thoughtful design which no theory of 'evolution' or 'use' can ever upset. The horse is one of the oldest of our domestic animals. It is frequently alluded to in Genesis, and is sent down to posterity on the monuments of the ancient Egyptians, who were probably, as suggested by Gray, the first to tame its wild spirit, and yet during that long period we have no evidence that it has varied in the slightest degree. Cuvier

[1] *Cyclopædia of Anatomy and Physiology*, Art. 'Solipeda,' by T. Rymer Jones.

could detect no difference except that of size between the fossil and the recent horse, although Meyer and Kaup have detected differences in the teeth of the Pliocene and Miocene deposits of the Continent.[1]

But we are talking of remote ages, and of the same geological deposit in which the remains of monkeys like those of the present day have been found. In those remote ages the horse was still a horse. He was not what Darwin or Huxley would term his tapir or hipparion-like ancestor. As a horse, then, the beautiful structure I have detailed above would belong to him in the Miocene geological period as well as in the present day. What a glorious proof of the permanence of species and of the truth of final causes!

We cannot compute the time which has elapsed since the Miocene period, but the horse and its beautifully adapted hoof have continued unaltered since then. What a sublime thought! How the petty substitutes for the teleological argument put forth by the Darwinian school sink into insignificance before this unanswerable fact.

[1] Owen, *British Fossil Mammalia*, p. 385.

CHAPTER X.

THE VARIATION AND NATURAL SELECTION ARGUMENT CONTINUED.

The Descent of Man.—Founded upon Häkel's genetic views.—Resemblances between man and inferior animals not a sound mode of reasoning in favour of their genetic connection.—Human disease not propagated to animals, as stated by Darwin.—Mr. Woolner's ear a myth.—Therefore its assumed proof of man's cocked ears untrue.—The semilunar fold.—Smell.—Erroneous statement of Darwin as to the faculty in Man.—Griesinger's theory of Mind.—Mr. Darwin's views upon human hair.—Their genetic connection with animals unsound.—'Wisdom teeth.'—Darwin's view of their degradation.—Structure of animals and man said by Darwin to be identical and proof of a common descent.

Mr. Darwin's last work, the 'Descent of Man and Selection in Relation to Sex,' is the next and last work which requires examination.

In this work Mr. Darwin has amplified and followed out the assumed genetic descent of man enunciated by Häkel in his 'Natürliche Schöpfungsgeschichte.'

Mr. Darwin remarks: 'Had this work appeared before my essay had been written I should probably never have written it.' Häkel's views, however, were well known for two or three years before Mr. Darwin's book was published.

Mr. Darwin commences his work by defining the resemblances which exist between man and the inferior animals. Animals of the vertebrate type being all formed upon a plan which is essentially similar, it seems a work of supererogation to make any comparison between man's skeleton, muscles, nerves, blood-vessels, and internal viscera, and those of a monkey, bat, or seal.

All these animals have to move, eat, digest, and sleep, and it would be a monstrous thing to assert that if each were separately created they should have had different structures given them to perform similar duties. Mr. Darwin then alludes to diseases, and makes the following incorrect statement: 'Man is liable to receive from the lower animals, and to communicate to them, certain diseases, as hydrophobia, variola, the glanders, &c.' The answer to this is, that man may receive from animals hydrophobia and glanders, but I know of no case on record where these diseases were *communicated* from man to animals. Of course, the mere carrying of glanders secretion from one horse to another by the groom is not a case in point. As to *variola*, it has been clearly proved by Dr. Budd of Bristol that the variola of sheep is not communicated by or to man, but is, in fact, a distinct disease; therefore Mr. Darwin's conclusion that 'this fact proves the close similarity of their tissues and blood' falls to the ground. Nay, further, the similarity alluded to does not exist in fact, as the blood-discs of man differ essentially from all other mammals. It is a favourite argument to tell us that 'monkeys have apoplexy, inflammation of the bowels, and cataract;' so have horses, dogs, and cats, &c. That a baboon may be induced to drink beer till he is drunk is overbalanced by the fact that such potations cure him of the drinking, which is exactly the reverse of what takes place with his more 'intelligent relative' man. Then, again, Mr. Darwin tells us that man is affected with external parasites which belong to the same genera or families with those infesting inferior mammals. The same thing may be said of birds, each having a parasite peculiar to itself, but belonging to the same genera and families.

Mr. Darwin is quite welcome to all the assistance his theory can obtain from the similarity between the different families and genera of such organisms.

Then Mr. Darwin reaches his strong point, in which he endeavours to make large capital out of the presumed similarity between the embryo of a human being and a dog. I have elsewhere given my reasons for dissenting from this mode of argument, and I have sought in vain to discover that similarity between the two figures which he gives (vol. i. p. 13), and endeavours to establish. To my mind they are very much like what they are intended to represent. Mr. Darwin is singularly unfortunate in his illustrations, for immediately afterwards he quotes from Huxley: 'Without a doubt man is far nearer to the apes than the apes are to a dog,' making the presumed similarity between dog and man a long way off after all.

The next figure given by Mr. Darwin is Mr. Woolner's ear, with a slight point projecting from the inner margin of the helix. I have looked in vain for a specimen of 'Woolner's ear' since the appearance of Mr. Darwin's work, for upon that little point he jumps at once to the conclusion that men's ancestors had pointed ears, which they could cock up at pleasure, like those of a skilfully cut dog. And this may be taken as a very fair example of the delusions which prevail throughout Mr. Darwin's book, for I will venture to say that a more doubtful deduction from a small fact was never before made except by Mr. Darwin himself.

The semilunar fold, a structure which, in the upper Mammalia, is part of the apparatus for directing the tears from the lachrymal gland, is stated by homological and analogy-loving anatomists to be the *rudiment* of the nictitating membrane of birds, a structure having muscles and other appendages, by which it is used for a very salutary purpose, and this is seized upon by Mr. Darwin to support his theory. It would be a really useful fact to theorise upon could he show us the living form in which the gradual change—for Mr. Darwin swears by the maxim *Natura non facit saltum*—had occurred from the nictitating membrane of the owl up to the semilunar fold of man and apes. But this he cannot do. Neither, as far as I am aware, can he carry it in the opposite direction below the fishes.

The sense of smell, Mr. Darwin thinks, has been inherited in an 'enfeebled and so far rudimentary condition from some early progenitor, to whom it was highly serviceable, and by whom it was continually used;' and this, continues Mr. Darwin, enables us to understand 'how it is, as Dr. Maudsley has truly remarked, that the sense of smell in man is singularly effective in recalling vividly the ideas and images of forgotten scenes and places; for we see in those animals which have this sense highly developed, such as dogs and horses, that old recollections of persons and places are strongly associated with their odour.'

I do not think it would be possible to find in the literature of our time so many erroneous statements, nor a deduction so grossly unsound as is shown in the above passage. First, it is not true to say that the sense of smell is 'enfeebled or in a rudimentary condition in man.' No animal enjoys the sense more exquisitely or more adaptedly than man does; and for this purpose he has a most beautiful and elaborate apparatus of turbinated bones, mucous membranes, and delicate nerves in myriads provided for him. He can indulge in all beautiful odours which constitute some of the greatest charms of life, and he is able, by appreciating disagreeable smells, to avoid the inhalation of vapours which would be injurious to his health.

It is quite true that the olfactory nerve in man is smaller than it is in animals, but then it has one remarkable peculiarity, viz. that of containing a larger proportion of grey nervous matter than any other cerebral nerve. This grey matter is that part of the brain which psychologists and physiologists unite in fixing as the especial seat of thought, sensation, and the manifestations of the intellect.

One of the most celebrated writers on mental disorders of the present day, Griesinger, has described the human mind as commencing in the nerves of sense and terminating in the brain, having immaterial intelligence between the two. The sense of smell then in man is neither enfeebled nor rudimentary, and is most serviceable to him by whom it is continuously used. The wolf hunts its prey by scent, and its olfactory apparatus is adapted accordingly. Man uses the function in connection with the higher operations of intellect, and in him the apparatus is adapted to its special use. I certainly never heard of a horse exercising its sense of smell so as to recollect persons or places, though dogs undoubtedly do so. I was once driving a favourite old horse who stopped suddenly before a cottage where I had taken him frequently seven years previously. The sense of smell could have had nothing to do with the horse's recognition of the cottage in this case.

Mr. Darwin considers the hairs scattered over the human body are the 'rudiments of the uniform hairy coat of the lower animals.' But the supposition is, if looked into, a very absurd one. Why, upon Mr. Darwin's theory, should man have hair upon his head, axillæ, and other parts, if the peculiar disposition of his hair were not an absolute specific character, and not one that is merely inherited? Why should one portion of the human race be hairless and the other hairy? Surely, if the hairs on our body were inherited from the lower animals, the naked savage ought to have retained the peculiarity in all its integrity. The fact of a human fœtus in utero having no hairs upon the soles of its feet nor the palms of its hands is looked upon by Mr. Darwin as a significant fact, 'because such is the case with the surfaces of all four extremities in most of the lower animals.' But Mr. Darwin forgets that hairs upon a man's hand or the sole of his foot would be an unnecessary incumbrance, and opposed to the beautiful design by which his structure is adapted to the purposes of his existence. Mr. Darwin's mind—and alas! those of his followers—is warped by the necessity of considering everything in human structure as the product of a theory which has never been proved. Then Mr. Darwin tells us that our 'wisdom teeth' are tending to become 'rudimentary' as we grow more civilised; that black men have this tooth sound with three fangs because they live upon uncooked food, while civilised man uses his jaw less upon cooked soft food, and therefore his jaw grows shorter, which obliges Americans to remove some of the molars from the jaws of their children! But we do not pull out the molars of our children in England, which fact, according to Mr. Darwin's statement, would make us less civilised than our American cousins! Such writing as this is not much calculated to support Mr. Darwin's theory. I pass over the 'supra-condyloid foramen,' Professor Turner's rudimentary tail muscle, Luschka's 'convoluted body,' and the homologies of the prostate gland, for these are points accepted by anatomists or rejected according to their Darwinian proclivities, and must be settled among themselves. That the vesicula prostatica, which has a distinct function assigned to it, should be considered 'universally' as the homologue of the female uterus, may or may not be true. If it be true, it speaks, I think, but poorly for the intellects of modern anatomists.

Mr. Darwin concludes his first chapter by a summary, in which he considers the homologies, the facts of development, and the rudimentary organs which we have just dealt with, ought to lead us 'frankly to admit' the community of descent of man and the inferior animals, and that to take any other view is 'to admit that our own structure and that of all the animals around us is a mere snare to entrap our judgment,' and that 'it is only our natural prejudice and that arrogance which made our forefathers declare they were descended from demigods which leads us to demur to this conclusion.'

As these passages contain the essential points of Mr. Darwin's doctrine, they will receive fuller and more particular notice in the course of this work.

CHAPTER XI.

THE VARIATION AND NATURAL SELECTION ARGUMENT CONTINUED.

Mental powers.—Mr. Darwin's opinion that in man and the lower animals there is no fundamental difference considered.—The emotions.—Animals have pleasure, pain, happiness and misery, terror, suspicion, courage, revenge, wonder, curiosity, imitation, attention, memory, imagination and reason. — Language. — Mr. Darwin's erroneous notions about the songs of birds drawn from bird-fanciers.—Young birds not taught by their parents to sing.—Mr. Darwin's ideal monkey that laid the foundation of its language.—Self-consciousness, individuality, abstraction.—General ideas passed over by Darwin, though considered by recent writers as making a complete distinction between man and animals.—Atoms of brain not atoms of mind.—Belief in God.—Religion.—Love of dog for master supposed by Darwin to be a distant approach to religious feeling.

In Chapter II. Mr. Darwin commences his arguments and evidence to prove that there is no fundamental difference between the mental powers of man and the lower animals, and that, just as the difference between the mental power of one of the lower fishes and one of the higher apes has been filled up by numberless stages or gradations, so the less interval of mental power between the highest ape and the lowest man has been filled up in a similar manner. In other words, he means that from the mental power enjoyed by ascidians or fishes has sprung, by numberless efforts of evolution, the intellect, the reason, and the moral sense of man. Mr. Darwin admits that the moral sense is much more developed in a Howard or a Clarkson, and the intellect of a Newton or a Shakespeare, than that of a savage; but he contends that they are 'connected by the finest gradations,' and 'therefore it is possible that they might pass and be developed into each other.' In the chapter under consideration Mr. Darwin confines himself to the endeavour 'to show that there is no fundamental difference between man and the higher mammals in their mental faculties.'

And, first, as to the emotions.

The lower animals feel pleasure, pain, happiness, and misery. Terror produces the same effect upon them that it does upon us. 'Suspicion, the offspring of fear, is eminently characteristic of most wild animals.' Dogs have a variable amount of courage. Some dogs and horses are ill-tempered, and *vice versâ*; and these qualities are inherited. Animals are capable of revenge. Animals love their masters; and Rengger observed an American monkey carefully driving away the flies which plagued her infant; and Duvaucel saw another washing the faces of her young ones in a stream. Monkeys have intense grief, and various anecdotes are told of their intelligence. All this is perfectly true, and is very pleasant reading.

Then all animals feel wonder, and many curiosity;

and Mr. Darwin tells amusing anecdotes to prove this.

Imitation is shown by parrots and some birds, who learn other birds' songs.

Attention is shown by cats watching mice; and the fact that monkeys are more easily taught tricks if they are 'attentive' to their teacher.

It is self-evident that an attentive monkey will learn more quickly than an inattentive one; and I think Mr. Darwin has altogether misapplied the patience of a cat when waiting for its prey, to that 'attention' which is connected with intellectual advancement.

Animals, then, have MEMORY for persons and places; and, as dogs, cats, horses, and birds have dreams, Mr. Darwin gives them IMAGINATION also; and, to sum up, all animals possess a certain amount of REASON.

Now it would be a waste of time to dispute all these propositions; with the exception of the last, I admit most of them freely. Mr. Darwin occupies more space in the discussion of LANGUAGE; and, as this is one of the great stumbling-blocks in his way, he is obliged to get over the difficulty by one of those enormous assumptions with which the book is full. Animals, such as monkeys and dogs, are quoted as possessing means of expressing their wants by certain sounds. But why did Mr. Darwin confine himself to monkeys and dogs? Why not quote the neighing of the horse, the braying of the ass, the lowing of the ox, the cawing of the rook, the crowing of the cock, or the songs of birds? There is nothing more wonderful in the peculiar whine by which the dog tells you he wants to get out of the window than in the row kicked up by a pig which is shut out from its dinner or its young. Neither can I see anything in the argument, often used, that articulate language is peculiar to man; for I have a cockatoo which answers 'Yes, sir,' when I call the boy, much more clearly than the boy does himself. And it is quite certain that the language of animals among themselves is as perfectly understood as articulate language with us.

But Mr. Darwin has put the question in its true light, when he remarks that the distinction consists in the '*large*' power which man has 'of connecting definite sounds with definite ideas.' It is in the word *large* which, in fact, consists the real difference; for, when my cockatoo finds the servants at supper and the kitchen door is open, I often hear him, in a soft coaxing tone of voice, calling 'Pretty fellow, pretty cock-a-too'; and the definite idea in cockey's mind is connected with tit-bits from the supper table. The definite sound is associated here with the definite idea. Man can connect the definite idea with the definite sound more 'largely,' more comprehensively. He can exercise his higher faculties in a thousand different ways, so as to connect definite ideas with definite sounds; and Mr. Darwin says this 'obviously depends upon the development of the mental faculties.' It would have been more correct had Mr. Darwin said a 'higher' development; for I by no means agree with that gentleman that the 'development of the mental faculties' depends upon the gradual evolution of higher from lower conditions, as he says language has 'been slowly and unconsciously developed by many steps.' In support of this argument, Mr. Darwin has again made one of those plausible assumptions which are so common throughout his writings, and which, if examined closely, utterly break down his own theory. He says (vol. i. p. 55): 'The sounds uttered by birds offer, in several respects, the nearest analogy to language, for all the members of the same species utter the same instinctive cries expressive of their emotions; and all the kinds that have the power of singing exert this power instinctively; but the actual song, and even the call-notes, are learnt from their parents or foster-parents.'

This is altogether, as far as the latter clause in the quotation goes, an erroneous statement of facts. Mr. Darwin has drawn what he considers his proofs from the experience of bird-fanciers with poor birds in confinement. In such an unnatural condition young singing birds will learn the notes of other birds with which they associate; *but, if kept quite alone,* they will sing their own natural song, as several who have tried the experiment assure me.

But Mr. Darwin forgets, when he applies his artificial facts to nature, that most birds, as a rule, only sing during incubation. Take, for instance, the nightingale. The songs of these birds will cease about the first week in June, when most of their eggs are hatched. The young birds never hear the song of their father! How, then, can it be said that he teaches them how to sing? Does the hedge-sparrow, or the water-wagtail, or the reed-warbler teach the young cuckoo its 'call-notes'? Does the blackbird, or skylark, or grey linnet, taken from its nest by the bird-nesting schoolboy, never sing its natural song without being taught? I should be ashamed to ask these questions of any one versed in practical natural history.

There is just as much truth in Mr. Darwin's statement about the song or the call-notes of birds as there is in that of Mr. Wallace, that young tom-tits are taught by their mothers how to build their nests. Who, looking at a nest of young birds with their mouths wide open to receive food, will for a moment believe the monstrous doctrine that they are at the same time undergoing education in singing and building nests? As to the origin of languages, Mr. Darwin's account puts us in mind of the bear and whale story in the first edition of the 'Origin of Species,' but wisely left out in the later issues. He says, 'As monkeys certainly understand much that is said to them by man, and as in a state of nature they utter signal cries of danger to their fellows, it does not appear altogether incredible that some unusually wise ape-like animal should have thought of imitating the growl of a beast of prey, so as to indicate to his fellow-monkeys the nature of the expected danger. *And this would have been the first step in the formation of a language.*'

Mark also the tone of assumption used by Mr. Darwin in working out a case of such enormous importance: 'It is not *altogether* incredible that *some* ape-like ancestor should,' &c. Why, it is absolutely essential to the case, which he afterwards formulates so positively, that the ape-like progenitor should be *proved* to have existed, and that it did actually imitate the growls of animals as warnings to its fellow-apeiform brethren.

Self-Consciousness, Individuality, Abstraction, General Ideas, &c., Mr. Darwin wisely passes over, for, as he says, they, according to recent writers, make the sole and complete distinction between man and the brutes. He thinks, however, that a dog when dreaming after the chase, *may* be dreaming of the pleasures of the chase, and this *would* be a form of self-consciousness; and also that a dog in whose mind his voice had awakened a train of old associations 'must have retained his mental individuality, although every atom of his brain had *probably* undergone change more than once during the interval of five years.'

Surely Mr. Darwin does not seriously believe that the atoms of brain are atoms of *mind*? and yet upon this assumption he does not hesitate to answer Dr. McCann's admirable strictures upon evolutionism, viz., 'The teaching that atoms leave their impressions as legacies to other atoms falling into the places they have vacated is contradictory of the utterances of consciousness, and is therefore false; but it is the teaching necessitated by evolutionism, consequently the hypothesis is a false one.'[1] Physiology teaches us that the liver, no matter how often soever its atoms may have been changed in a series of years, will still secrete bile. The liver is the organ by whose means an immaterial power or force performs its duties. The material structure changes as often as it is 'used up.' The immaterial power or force being vital never changes, nor is diseased. So with the brain. The force which governs all mental operations—mind, in fact—is immaterial and indestructible; and thus by its means we know events which passed in our youth even in old age. It is not the material brain atom in which memory resides, but in the intelligence or mind, which is immaterial. The latter is the vital power or force which perceives, wills, directs. The brain atom is the material element which performs its function like the cell of the liver, and then passes away, and is replaced by fresh atoms.

Mr. Darwin believes that animals, especially birds, have *a sense of beauty*, and I see no harm in admitting the possibility, but we must remember that our sense of beauty may be very different from that entertained by animals.

[1] *Anti-Darwinism*, 1869, p. 13.

Belief in God—Religion. Mr. Darwin thinks it *probable*, with Mr. Tylor,[1] that dreams may have first given rise to the notions of spirits, and that a belief in spiritual agencies would easily pass into the belief in the existence of one or more gods. And he also thinks that the 'feeling of religious devotion is a highly complex one, consisting of love, complete submission to an exalted and mysterious superior, a strong sense of dependence, fear, reverence, gratitude, hope for the future, and *perhaps other elements.*' And Mr. Darwin's thorough appreciation of religious devotion is further exemplified when he says: 'Nevertheless, we see some distant approach to this state of mind in the deep love of a dog for its master, associated with complete submission, some fear, and *perhaps other feelings.*' And with this sentiment I pass on to the most difficult part of Mr. Darwin's task, viz., a consideration of his mode of reconciling his peculiar doctrines with the MORAL SENSE.

[1] *Early History of Mankind*, p. 6.

CHAPTER XII.

THE VARIATION AND NATURAL SELECTION ARGUMENT CONTINUED.

The Moral sense.—The 'I ought' and the 'I ought not.'—Difficulties insurmountable to Mr. Darwin.—His 'probabilities.'—The moral sense acquired from 'social instincts.'—Mr. Darwin's four reasons considered.—Moral feelings acquired, according to Mill.—Facts in support of this view.—Hunger called an 'instinct' by Darwin.—The illustration unsound.—Hunger a physiological event produced by a known cause.—Instinctive sympathies.—Mind or force, or both, lead the social community.—Cruelty of ignorant uneducated savages.—Its cause a want of education.—Communistic Socialism inferior to Socialism of Gorilla or other monkeys.—'Public opinion.'—Loose mode of argument.—Public opinion much higher than 'instinctive sympathy.'—The grandest of all moral forces the result of reason, and not instinct.—Habit strengthening instincts considered and refuted.—Fundamental difference between Instinct and Reason.—Men reared like hive bees.—Mal àpropos illustration.—Least action.—Rev. Professor Haughton.

The 'I ought' and the 'I ought not' are difficulties which I do not believe Mr. Darwin will ever overcome. He is quite sensible himself of these difficulties, but just as he saw means by which the human eye might be evolved from that which serves the purposes of vision in the lower animals—say the echinoderm or the lobster—so, with a determination which nothing can check, and a will which overcomes all difficulties, he approaches the subject of the human conscience, albeit fully alive to the difficult task he undertakes; for he knows full well that no animal in creation except man has a moral sense, and yet he has to prove that such an animal must have existed, or his whole hypothesis tumbles to the ground like a child's temple of cards.

With such material before him it is quite clear that the argument can only be sustained by suppositions or assumptions of organisms which have passed away from the face of Nature and left no record behind —even in Nature's book of stone. Let us hear, however, what are Mr. Darwin's probabilities. He begins with the following proposition: '*Any animal whatever, endowed with well marked social instincts, would inevitably acquire a moral sense or conscience, as soon as its intellectual powers had become as well developed, or nearly as well developed as in man.*'

In support of this 'probable' proposition Mr. Darwin has four reasons, upon which I will venture to make one or two comments.

First. Social instincts lead an animal to take pleasure in the society of its fellows, to sympathise with them, and to perform various services for them. Those services are definite or instinctive, or only a wish or readiness to aid their fellows; such feelings and services being confined to individuals of the same species or association.

Mr. Mill, the metaphysician, considers the moral feelings to be acquired, not innate; which, of course, upsets Mr. Darwin's first 'reason' for the 'probable' supposition. That the moral feelings are acquired is, I think, at once proved by the fact that they exist as a rule more or less according to the nature or extent of education; and it is one of the strongest arguments against Mr. Darwin's views that *you cannot educate an animal up to a moral sense.* There are vast numbers of our fellow-creatures whose mental culture has never been sufficient to develop the germ of moral feelings within them; or the germ may have been laid and sprouted in early life under a mother's care, or that religious nurture which I hope will ever mark the education of our fellow-creatures, and again become lost by bad example and bad habits of life, which tend to make the sensuous supersede mental exercises. But the commission of some great crime will bring back into such minds the resemblance of that mother, or that spiritual teaching which has laid dormant even as though it had never existed. The most hardened criminal seldom fails to meet his doom with the contrition, remorse, and moral pain of a guilty CONSCIENCE.

So far from the 'social instinct' being the origin of a moral sense, or rather the cause of its development as argued by Mr. Darwin, I venture to state, without fear of contradiction, that the effect, according to human experience, is quite the contrary. Nothing tends more to deaden or obliterate the moral sense than the 'social instincts' as witnessed in our beershops and the saloons of immorality and vice which disgrace large cities. On the other hand, it is the lone solitary man who lives among the inanimate things of creation in whom the moral sense becomes most highly developed; he who reads the book of nature and is led by her teachings from nature 'up to nature's God.'

Secondly. Mr. Darwin maintains that when the mental faculties had become highly developed, dissatisfaction from unsatisfied instincts would arise 'as often as it was perceived that the enduring and always present social instinct had yielded to some other instinct at the time stronger, but neither enduring in its nature nor leaving behind it a very vivid impression.' And this Mr. Darwin illustrates by 'instinctive desires, such as that of hunger, which are in their nature of short duration, and after being satisfied are not readily or vividly recalled.'

To begin with the illustration, I need not say to educated medical men that it is an unsound one. Hunger is not an instinctive desire. Physiologists know that it is physically produced by gastric juice having nothing to digest in an empty stomach. Mr. Darwin confounds the instinctive act of the new-born infant seeking its food from the mother's breast with the hunger which calls the instinctive act into existence! both of which, I may say *en passant*, are beautiful instances of that design which Mr. Darwin and his followers so persistently repudiate.

Thirdly. Mr. Darwin says, 'after the power of language had been acquired and the wishes of the community could be expressed, the common opinion how each member ought to act for the public good would naturally become to a large extent the guide to action. But the social instincts would still give the impulse to act for the good of the community, this impulse being strengthened, directed, and sometimes deflected by public opinion, the power of which rests, as we shall presently see, on instinctive sympathy.'

The history of barbarous or savage races does not much support Mr. Darwin's views, and I suppose we must look to them as the nearest approach to his race of 'manlike animals.' Instead of the 'social instinct' acting for the good of the community, the facts we see are superior mind or superior force, or both combined, leading the social community, which the said superior mind or force most frequently treats with unbounded cruelty and tyranny. In fact the whole savage world, both in its past and present history, is a salient proof that the moral sense does not spring from social sympathies, but that it is a high and noble attribute of mind brought out or developed by mental and religious education. We every day see bodies of men who, having opportunities of exercising the 'social instincts' to their utmost limits, display the total absence of a moral sense by committing unbounded acts of cruelty, like the African Dahomey or the Parisian Commune.

It is quite certain that such ~~deeds of~~ monstrosity as we have recently seen under even the very boast of Socialism would not have been done by bodies of gorillas, or any other tribes of monkeys or animals who have not been 'developed' up to the acquisition of language, but who possess 'instincts' to perfection. I need hardly notice the loose way in which Mr. Darwin argues his subject when he talks of the power of public opinion being due to instinctive sympathy. These are the sort of phrases which he invents to cover the difficulties which must so frequently arise in defining the intellectual position of man's 'ape-like ancestors.' Public opinion may be of such a character in a community of monkeys, although we have no proof that such is the case. And such may, and undoubtedly is, the moving principle of action in the senseless howlings of a political mob. But I look upon public opinion as something far higher than this. It is the grandest of all moral forces when exerted in a good cause, and the most dangerous and ignoble when used to further a bad one. In both cases, however, it is the result of the reasoning, and not of the instinctive powers.

Mr. Darwin, who evidently believes that reason has been evolved by slow successive steps from instinct, may be excused for holding the doctrine that the power of popular opinion is due to instinctive sympathy; but in doing so he degrades the means by which some of the best and wisest changes in nations or dynasties have been effected.

Mr. Darwin's fourth and last reason for his 'probable proposition' is that 'habit' would ultimately play an important part in guiding the conduct of each member, for the social instinct and impulse, like all other instincts, would be greatly strengthened by habit, as would obedience to the wishes and judgment of the community.

Habit increasing *instincts*! Surely there is here a contradiction in terms? The very word Instinct carries with it the fact that it is a power or influence which is exercised in the living animal independently of will. Argue as we may about the difference between Instinct and Reason, their fundamental difference can never be overthrown. Neither ought it to be strained to meet the requirements of improbable hypotheses, or be degraded to suit this or that theory of the speculators upon recondite questions in biology.

Mr. Darwin says that if 'men were reared under precisely the same conditions as hive bees, there can hardly be a doubt that our unmarried females would, like the worker bees, think it a sacred duty to kill their brothers, and mothers would strive to kill their fertile daughters; and no one would think of interfering.' (Vol. i. p. 73.)

But why put an impossible case to illustrate his theory? The next passage tells us why. 'Nevertheless the bee, or any other social animal, would, in our supposed case, gain—as it appears to me—some feeling of right and wrong, or a conscience.'

In other words, if men were to be transmuted into bees and bees into men, the former would build their comb by instinct, the latter would raise their houses by reason. Men would cease to have a conscience and bees would gain one. All of which appears to me something very like a *petitio principii.* The illustration is in another sense mal àpropos. Man's highest attainments—even those of the most gifted scholar or artist that ever lived—would fail in making by reason what the bee does by instinct. Without the aid of geometry and complex machinery man could not make a honeycomb; for it is one of the finest examples in nature of what is termed the principle of 'least action;' that is to say, the greatest amount of space is gained by the least amount of material. Who or what made the bee a geometer of the first class?—and who or what made it able to carry out its architecture with infallible success? Man, by the aid of reason, can work out the most difficult problems, and can base upon the principles so worked out the most delicate and beautiful works of art. But the young bee has no reason—no instruction—no scholarship—no mathematical genius. A mere white grub becomes a winged insect, and this insect puts reason and mathematics and learning and genius on one side, and constructs its cell according to a law—that of 'least action'—which must be Divine, inasmuch as it is the grand law upon which animal structure is built up, and by which animal structure performs its duties in the functions of life.

Men who are blinded by the gross materialistic doctrines of the new school, will not see or feel that the blind cannot lead the blind—that neither instinct nor reason can originate a mathematical law, how much soever the acuteness of the latter may lead him who possesses it to *discover* that which a greater mind than his has created.

The Rev. Dr. Haughton has, by great toil and the exercise of a genius of a rare order, worked out the principle of 'least action,' and has proved that it is a leading law in nature; that it influences the motions of the planets round the sun; that it is the basis of the law of refraction; that every muscle in the animal world is formed, fixed, and acts by its means; that every ounce of muscle in the human heart has during its action to use a force equivalent to raising 20 lb.; and that by the principle of 'least action' this organ is made to perform this enormous work—as great as that done during the twenty minutes of the Oxford and Cambridge boat-raçe—for seventy, eighty, or a hundred years of human life.[1]

Mr. Darwin has a great many pleasing anecdotes to prove the sociability of animals—which, however, I fully admit, nor do I wish in the slightest degree to derogate from the interest those anecdotes must create; but when he tells us at page 78 that dogs have something very like a conscience, I can only refer him to his own words at p. 73: 'It may be

[1] Lecture at the Royal Institution.

as well to premise that I do not wish to maintain that any strictly social animal, if its intellectual faculties were to become as active and as highly-developed as in man, could acquire exactly the same moral sense as ours.'

CHAPTER XIII.

THE VARIATION AND NATURAL SELECTION ARGUMENT CONTINUED.

Man's development.—Variation in Muscles: Professors Turner, Macalister and Wood upon.—Such variations probably the result of 'least action.'—Mr. Darwin's opinion that this variation is due to 'reversion.'—Professor Haughton's opinion of Darwinism.—Reasons for believing in the principle of 'least action,' as applied to variation in Muscles.—Mr. Wood's 'factor,' discovered.—Correlated variation, rate of increase, and natural selection considered.—Hair, Tail.

On the Manner of Development of Man from some Lower Forms.

SUCH is the heading of Mr. Darwin's fourth chapter. Having, from data the most unsound, assumed that it is so, Mr. Darwin proceeds to tell us how it was done. And first—

Man is a Variable Animal. That is to say, his organic structure is frequently found to vary from the normal type. It is quite true that no two men are quite alike in face or figure. And the same may be said of a flock of sheep, which the shepherd is said to recognise individually. It is quite true that Mr. Wood and Professor Turner, and Professor Macalister, and others not mentioned by Mr. Darwin, have found the muscles of the human body to be different in shape, size, and attachment; and much Darwinian argument has been made out of those variations which are thought to be links in Mr. Darwin's chain, because they resemble some of the unvaried muscles of the lower animals. But it is quite certain that these authorities—and I admit they are high ones—have never told us that these variations in structure have not fulfilled the functions allotted to them. It is quite possible that any deviation in the bony skeleton, so frequently the result of disease, may have rendered a different disposition of these muscular fibres necessary, and this may have been done upon the principle of 'least action,' and therefore be of great teleological significance.

Mr. Darwin admits that we are in all cases very ignorant of the causes of variability, and this very ignorance gives some plausibility to the suppositions I have given above; for upon the great law of 'least action' our knowledge is still in its infancy, and its growth must necessarily be slow in an age when Darwinism is permitted to supersede the exalted principles of teleology, which are at once the wonder and delight of those students of nature who are content to limit their speculations within the range of human reason.

Mr. Darwin passes from a consideration of the moral sense to 'the manner of development of man from some lower forms,' and again he begs the question in opening the fourth chapter: 'We have seen in the first chapter that the homological structure of man, his embryological development, and the rudiments which he still retains, all declare in the plainest manner that he is descended from some lower form. The possession of exalted mental powers is no insuperable objection to the conclusion.'

But, then, he admits directly after that it is impossible to obtain direct evidence as to the variation—which must have been essential in man's 'ape-like ancestor' to evolve him into man—therefore he proceeds to examine into variability in man, assuming that, if he proves it in his case, he does so at the same time for his ancestor.

Mr. Darwin's chief supporters at this point are the well-known anatomists, Huxley, Flower, and Wood. The latter has been kind enough to send me his papers published in the 'Philosophical Transactions,' which are most clear and undoubted as far as the facts go, and they are well illustrated.

My friend Mr. Wood concludes his investigations into the numerous instances of muscular variation with the following—what Mr. Darwin calls piquant—remark:—'Notable departures from the ordinary type of the muscular structures run in grooves or directions which must be taken to indicate some unknown factor of much importance to a comprehensive knowledge of general and scientific anatomy.'

Mr. Darwin believes that this 'unknown factor' is reversion to a former state of existence. He places the muscles, in fact, in the same category as the now hackneyed bars on the pigeon's wing. That such an argument is untenable a moment's consideration will render evident. Bars on pigeons' wings, stripes on asses' legs, feathers on peacocks' shoulders, and such like phenomena, may or may not be instances of 'reversion,' but they have nothing whatever to do with the mechanical actions of the human body. Mr. Wood's variations, on the contrary, refer to a similarity between certain muscles on the human neck, shoulder, and chest, as perceived by him in the dissecting-room of King's College, and the homologous muscles of certain animals, such as the hyæna, deer, polecat, genette, coati, and marmot. And these muscles have distinct and unalterable functions in the economy to perform. The explanation of Mr. Wood's factor appears to me perfectly intelligible by the law of 'least action.' Professsor Haughton—whose sarcasm Mr. Darwin, at p. 129, vol. i., innocently takes for reality—writes me word: 'If I can predict the positions of sockets and the prominences of bones, and the muscles required to move them, from principles of geometry, then it seems to me that the arguments in favour of descent of animals from a *common ancestor*, derived from similarity of skeletons and muscles, will fall to the ground; because the arrangement of bones and muscles must be similar, if they have to do similar work in the most perfect way.' Now, admitting the truth of this—and its truth is self-evident—it follows that the variations found in the human muscles, as described by Mr. Wood and others, depend upon abnormities of the skeleton. In a perfect skeleton muscles must be typically normal and perfectly adapted to their work; but if a man has an abnormally-formed skeleton, the result of ancestral disease—and such are of daily occurrence—it is self-evident that the muscles which are attached thereto would not perform their functions correctly. Therefore Nature, on the principle of 'least action,' steps in and adapts the muscular structure in a manner best fitted to perform its work, modifying it in this or that animal according to the special necessity of the case. A muscular structure of typical formation would be *abnormal* on a skeleton whose bones have been shortened or lengthened, or whose tuberosities have been driven apart or drawn nearer to each other by rickets in a man's ancestor; for Mr. Darwin does not deny that abnormities of structure so produced are hereditary. Therefore I think that Mr. Wood's factor is easily pointed out; and it will be no answer to my position that the skeletons of such subjects 'appeared' to be of the usual normal character. A very short deviation from typical form would be sufficient to call the principle of 'least action' into play; so that in one case you have a muscle on the plan of a long-necked animal (fallow-deer), in another on that of a short-necked mammal (hedgehog). This view of the matter amounts almost to certainty when we reflect that it has a sound logical basis; while the idea of 'reversion' of structures, which were formed and adapted to perform distinct and different functions, is, to say the least of it, very problematical. And the theory I have set forth answers at once Mr. Darwin's statement that, 'if a man is descended from some ape-like creature, no valid reason can be assigned why certain muscles should not suddenly reappear, after an interval of many thousand generations, in the same manner as with horses, asses, and mules, dark-coloured stripes suddenly reappear on the legs and shoulders after an interval of hundreds or, more probably, thousands of years.'

'Correlated Variation,' 'Rate of Increase,' and 'Natural Selection,' are the three heads under which Mr. Darwin continues his observations upon physical development in Chapter IV. A very few remarks upon these headings will be sufficient. At page 134 there is a characteristic instance of Mr. Darwin's false mode of reasoning: 'If we look to an extremely remote epoch, before man had arrived at the dignity of manhood he would have been guided more by instinct and less by reason than are savages at the present time.' Mark the suppositions, which in this passage are taken as facts: man's 'early ancestor,' and his gaining reason by evolution from instinct; for, if the passage means anything, it is that man, in that early period of his history, had more instinct than reason—that the latter, in fact, was subordinate to the former; and then it was that our ancestors would not have committed infanticide; inferring, of course, that man's mental development has been from the good to the bad. Our ancestors, says Mr. Darwin, would have had, in those halcyon days, no 'prudential restraint from marriage, and the sexes would have freely united at an early age.' And then immediately the fact strikes him that the human race ought to have been immensely more numerous than it is now; therefore 'the progenitors of man would have tended to increase rapidly, but checks of some kind, either periodical or constant, must have kept down their numbers even more severely than with existing savages.' What these checks were Mr. Darwin, of course, cannot tell; and it would be indeed surprising if he could, considering that the ape-like progenitors and their instincts, and early marriages and rapid increase, are all mere unfounded images of his own fertile imagination.

I need not say much here upon 'natural selection.' Mr. Darwin himself has modified his views upon the subject; and, as stated before, Mr. St. George Mivart, in his 'Genesis of Species,' has utterly demolished its pretensions as a basis of scientific truth. One or two of Mr. Darwin's peculiar views may, however, be noticed. At p. 144 he tells us that 'the free use of the arms and hands—*partly the cause* and partly the result of man's erect position—appears to have led, in an indirect manner, to other modifications of structure.' First, it reduced his canine teeth, for the use of clubs and stones in fighting would leave less to do for the teeth, and they would decline accordingly; and then the jaws would follow suit!

Did Mr. Darwin or any other naturalist ever *see* an ape throw a stone? Waterton long since proved that they never could and never did throw stones. Therefore our ancestor had the ape's canines *after* he began to throw stones. We are getting by degrees most valuable evidence about our venerable predecessor. On the same page (144) we are told that as the jaws and teeth became reduced in size the skull began to *enlarge*. Happy ancestral fact!—and then the brain would, with the increased activity of the mental faculties, due to the civilising process of using clubs and throwing stones, 'almost certainly have become larger'; by which he means us to believe that the faculties came first and the brain afterwards! With singular inconsistency, Mr. Darwin says that the well-fed and constantly 'jaw-using' tame rabbit has a smaller brain than the wild one, because its intellects, instincts, and senses are less used. And on the opposite page he informs us that 'lop-eared rabbits' have the bones on the two sides of the head 'dragged' out of proportion to each other. I should very much rather venture an opinion that an original variation from disease of the bones of the head and face had caused the ear to 'drop,' than accept Mr. Darwin's solution.

The elephant and rhinoceros are now almost hairless; but the *woolly rhinoceros* existed in the Tertiary geological epoch; and the mammoth discovered in the eternal ice of Siberia was covered with hair. Mr. Darwin considers that their descendants have been deprived of their hair by exposure to heat. He ignores the teleological meaning contained in the fact that the elephant in India is more hairy in elevated and cool districts than his brother in the lowlands, and quotes it in support of his theory. Then he jumps to the inference that man was divested of his hair by living aboriginally in some tropical land—before, however, he was evolved into an erect being. And then he knocks the inference down, because he is met with the difficulty of hair upon the head of man; and other primates, even in hot regions, have the upper surface thickly clothed with hair; and he finishes the paragraph by offering his opinion that man, or rather woman, became divested of hair for ornamental purposes! Having thus finished the hairy difficulty, Mr. Darwin manfully grapples with the tail. What did our ancestor do with his tail? Did this go for ornamental purposes? Considering that some apes and even shepherds' dogs are tailless, this explanation would not do; and; although Mr. Darwin gets a few crumbs of comfort from Dr. Murie, who found nine or ten caudal vertebræ in a young monkey, which altogether were only one-eighth of an inch in length, and three of them, being *embedded*, therefore resembled the sacral vertebræ of man, yet, after careful consideration, and admitting that no explanation has 'ever been given of the loss of the tail by certain apes and *man*' (*sic*), he gives up the matter as one beyond the ken of his intellect.

CHAPTER XIV.

THE VARIATION AND NATURAL SELECTION ARGUMENT CONTINUED.

The Development of the Intellectual Faculties.—Great gulf to pass.—No link.—Mr. Darwin's views.—The 'affinities and genealogy of Man.'—Man descended from the Ape, and an animal like the larva of Ascidian.—The principle of like action being performed by similar means, ignored by Darwin and his disciples. Unity of human race essential to Darwinism; not the unity of the Mosaic account.—No remains ever found of animal intermediate between Man and Ape.—Time required for Darwin's evolution quite upsets his theory.—Mr. Darwin's parallel between Ant and Coccus.—Instinct and Reason.—The distinction laid down clearly by the 'Quarterly Review.'

Mr. Darwin has now, in the pursuit of his subject, a wider gulf to pass, and he has still no intermediate link to give plausibility or coherence to his subject. The 'ape-like ancestor' is a creature of the imagination. His varied progress, as shown in Mr. Darwin's imaginary history—in which he lost his canine teeth from the disuse which the more intellectual faculty of using clubs and throwing stones gave him; and, again, had his skull enlarged, because he used his canine teeth *less*, and which so gradually assumed human shape; his evolution, in fact, from ape to man, with its ten thousand variations—are all to be given credit for before the ground can be cleared to trace his mental development. Unfortunately, this imaginary part of the history is not only the most important, but it is one which it is incumbent upon any theorist to prove, or at least to give evidence of its probability, before he has a *right* to attempt by such means the solution of an issue so vast and important.

But nothing stops Mr. Darwin. Without a shadow of evidence that such a transmutation ever did take place, he rushes at once into the contest, and again brings 'natural selection' to the fore, with the old argument that, because the improvement of the intellect must have been of high importance to apes and man's 'ape-like progenitors,' therefore they must have been advanced and gradually perfected by natural selection. One of his principal arguments in support of this view is taken from the altogether unproved and unsound position that it is through 'their arts, but not conclusively, that civilised man has supplanted barbarous nations.' If the triumph of the strong over the weak, the persecution of designing settlers, the use of ardent spirits, the introduction of exhausting and exterminating diseases, are what Mr. Darwin means, I quite agree with him; but the arts of mankind are not to blame. Rather are such results due to the want of healthy moral feelings; the exercise of bad passions, unchecked either by education or religion. Man with his passions unbridled, and his moral sense uncultivated, is a worse and more dangerous animal than any not endowed with reason. And it is such men as these who persecute, kill down, and utterly destroy the savage. It is not the *art* which makes the gun, nor the 'fire-water,' nor the gunpowder, nor the sword, but the ill-directed intelligence of the mind by which they are wielded, which exterminates the savage.

In Chapter VI. Mr. Darwin arrives at the 'affinities' and genealogy of man, in which he includes what may be termed the culmination of his subject. He maintains the theory that man was not only descended from an ape, but he carries his pedigree down to the lowest of the Invertebrata, the larva, or an animal like the larva, of an Ascidian Mollusc.

The remaining part of the volume is occupied with what ought to have been a separate publication, following his last work,—what he terms 'Selection in Relation to Sex.'

I propose, before examining this part of the subject, to deal with the views entertained in Chapter VI.

As I have over and over again remarked, the most remarkable error which pervades the whole of Mr. Darwin's speculations upon the origin of species, and of those who support his views, is the persistent negation of the self-evident fact that like action—movement, development, in fact, all similar functions of animals—must necessarily be performed by similar means, whether the subject be a man, a monkey, a bird, or a fish. A certain end has to be gained, whether it be running, walking, jumping, flying, or swimming. A living body has to be propelled forward, through different media—on the ground, through the air, up a tree, or through water. If exceptional cases rise up in which the method of doing this be varied, the Darwinian immediately assumes that such variation is a proof of descent from a common ancestor. He ignores the great fact that, unless Nature stepped in with her compensating power, the automatic movements of the animal machine, so altered by variation or disease, would be stopped. Just apply the normal muscles of a deer or a hedgehog to the skeleton of a tiger, a monkey, or a man, and none of those animals would be able to move a step. So it is that, if the normal distance be altered by disease or variation between the origin and insertion of a particular muscle, then the compensating power of nature would be set up, and a muscle, after the pattern of a deer, or hedgehog, or rabbit, would be formed.

Mr. Darwin and his followers, misconceiving what has taken place, call such a changed muscle an instance of 'reversion' from our ancestor thousands of generations ago; making a demand upon our credulity ten times greater than any which is done by the doctrine of special creation. Thus does Mr. Darwin fall into grievous and fundamental errors. In the first two pages of Chapter VI. he tells us—'Man is liable to numerous slight and diversified variations, which are induced by the same general causes, and are transmitted in accordance with the same general laws as in the lower animals.' Now, I ask, what are these variations? What are the 'same general causes'? Where the proof of transmission? The answer to the first question depends in some measure upon the undecided question of the unity or multiplicity of the human race. The latter theory would, of course, be utterly destructive to Mr. Darwin's hypothesis. Therefore he struggles manfully to prove the truth of the former. Let us admit, simply for the sake of argument, that the varieties or races of men are of one species, and descended, according to Mr. Darwin's theory, from a common ancestor. Such an admission must not be confounded with the Mosaic account that Adam and Eve were specially and distinctly created by God. Mr. Darwin means no such thing. He repudiates special creation with almost as much vehemence as does Mr. Herbert Spencer; but with this part of the subject I have nothing to do in this work, inasmuch as I cannot in a scientific enquiry offer evidence not derived from scientific sources. But let us admit, for the sake of the argument, Mr. Darwin's unity of the human race. This race must have had a beginning, and assuredly has a history. Its beginning, upon Darwinian hypotheses, must have extended over vast periods of time, because there must first have been evolved a race of beings higher in the scale than monkeys; and this race again must have gone on varying; and being naturally selected, and varying again, have become more and more intelligent, until it reached the condition of the lowest known form of humanity. But Mr. Darwin justly says that the difference physically, and more especially mentally, between the lowest form of man and the highest anthropomorphous ape is enormous. Therefore the *time* —which in Darwinian evolution must be almost inconceivably slow—must have been *enormous* also during man's development from the monkey. The chance, therefore, of some of these variations being found in the different gravels or fresh-water formations above the tertiaries must be very great. And yet not one single variation, not one single specimen of a being between a monkey and a man has ever been found! Neither in the gravel, nor the drift-clay, nor the fresh-water beds, nor in the tertiaries below them, has there ever been discovered the remains of any member of the missing families between the monkey and the man, as *assumed* to have existed by Mr. Darwin. Have they gone down with depression of the earth's surface, and are they now covered with the sea? If so, it is beyond all probability that they should not also be found in those beds of cotemporary geological strata which have *not* gone down to the bottom of the sea; still more improbable that some portions should not be dredged from the ocean's bed, like the remains of the mammoth and rhinoceros, which are also found in fresh-water beds and gravel and drift! The time since these mammals lived on earth is immense, and yet they must have preceded man's ancestors, so-called, for no vestige of the latter are found with them. The remains of man and man's handywork have been discovered in beds of gravel and buried on the borders of lakes; and speculators, upon his 'antiquity' as a denizen of earth, say that he lived in remote ages, known as the Bronze and the Stone ages, when he made arms of flint, or forged bronze for the purposes of life. But the celebrated Neanderthal skull, about which so much has been said, belongs, confessedly, to this remote period, and yet presents, although it may have been the skull of an idiot, immense differences from the highest known anthropomorphous ape. And, in considering this fatal gap in Mr. Darwin's theory, it must be again called to mind that the intermediate forms must have been vast in numbers. Mr. St. G. Mivart believes that changes in evolution may occur more quickly than is generally believed; but Mr. Darwin sticks manfully to his belief, and again tells us *Natura non facit saltum.*

The change in the ape's skull, which was necessary to allow his canine teeth to diminish, from want of work in tearing his enemies, and the skull to enlarge, by reason of such less use of the jaws, must alone, upon Mr. Darwin's principle, have taken vast time to effect; and, granted that some of the other changes may have been correlative, yet, remember that you have to convert the four-handed ape into an erect man; a screaming baboon into an articulating, speaking being; brutal instinct into reason, will, conscience; a thing that perisheth into that which believes in God, and whose soul is immortal,—the time, I say, to do all this, according to evolution, must have been immense. The changes must have occurred among vast tribes, not in isolated pairs, and yet we have no evidence in the present, no voice in the stone book of the past, not one single footmark in the remains of bygone ages, not one tittle of evidence to justify man in his pride and presumption in attempting to bridge over the impassable gulf between the howling monkey and the being who, we are told, is formed in the image of ~~his~~ God.

Where, again I ask, are Mr. Darwin's variations? Where his causes? Where his proof of transmission?

Again, on p. 185, vol. i., Mr. Darwin tells us: 'Man tends to multiply at so rapid a rate that his offspring are necessarily exposed to a struggle for existence.' But if man had existed on the earth as long as Mr. Darwin considers necessary to transmute him from an ape, up to the far-off time when his remains prove him to have lived unaltered from his present condition, surely he must have existed now, in spite of all 'struggles,' in much vaster numbers than he really does. At p. 135 he tells us: 'The slowest breeder of all known animals, namely, the elephant, would in a few thousand years stock the whole world.' But he gives eons of time for man to have increased to his present numbers! How is this? Every advancement, physical or mental, must, according to Mr. Darwin's theory of natural selection, have been for the good of the individual, and so have gradually, but certainly, reduced his enemies and given him more power on earth. The struggle for existence would, therefore, have grown less *pari passu* with man's increasing intelligence, and the obstacles to his progressive increase proportionately removed. And yet the world is now far, very far from being filled with human beings. In these islands we are increasing rapidly; for the census, just completed, for 1871 shows a population in England and Wales of 22,704,108, as against 20,066,224 in 1861, being an increase of 2,637,884 in ten years. As ape-like men could not be expected to build ships and emigrate, they must have increased enormously, for a union of brute force and the worst part of reason would have given them an immense superiority over their unfortunate conquerors, who could only boast of qualities brutal; as they used their jaws less in slaying their enemies, and clubs and stones more, they must soon have become masters of the field and increased with great rapidity. Well, an age or two passes away, and some of this ape-like community have varied further in the human direction. But then, did their increase of reasoning powers and man-like attributes make them more brutal? And did they murder all those who were not so intelligent as themselves? Or did the 'residuum' take a retrograde line and vary downwards towards the Ascidian molluscoid? One of these alternatives *must* have been the consequence of the ape-like ancestors' progress, and I leave those who believe in Darwinism to solve the difficulty.

Mr. Darwin denies that man has a right to a separate position in the animal kingdom, because he has demonstrated that the difference between his mental powers and those of the inferior animals is only one of degree, and not essentially of such a different nature as to exclude the possibility of the higher human intellect having been evolved from the lower animal instincts. It is impossible to argue with any one who jumps to such conclusions as this, and yet Mr. Darwin's works are full of assumptions as groundless. He illustrates his position thus:—The female coccus insect attaches itself, when young, by its proboscis to a plant, sucks the sap, but never moves again; it is fertilised and lays eggs, and this is its whole history.

On the other hand, to describe the habits and mental powers of a female ant would require, as Pierre Huber has shown, a large volume. Therefore, as these insects belong to the same class, why separate man from the animal world, in which the difference is not so great as between the coccus and the ant? Now here Mr. Darwin commits a grand and fundamental error. Granting that some of the tales told about the ant are true—and I am quite sure that many of them are not—it does nothing which entitles it to rank as a reasoning animal. The coccus has a destiny, and so has the ant, and each is endowed with instincts fitting for the conditions of its existence. It is quite as wonderful that the coccus should have the peculiar instinct which is necessary for its existence—eating and breeding—as that the ant should be endowed with instincts suited for the same ends in its peculiar position. The great mistake made by Mr. Darwin is identifying reason-like attributes in animals with the reasoning faculties of man, and confusing the same with instinct, from which it entirely differs. At this moment there is a cow in the meadow in front of my garden which is bringing up a lamb as its own offspring. It allows the lamb to suck and gambol with it and jump upon its back when lying down, and it protects it from harm, as though it were really its own offspring. All this is done by instinct. Had the beast possessed reason, it would have been able to have *compared* the lamb with former calves—or, like Mr. Wallace's tom-tits, it ought to have inherited the knowledge that lambs were not calves. Again, the lamb ought to have been in the same position. Why did it not inherit the power of comparing a cow with its own mother, instead of showing the former all the attachment it would have done had the latter not died? All that Mr. Darwin or Huber tells us of ants merely shows a 'reason-like' intelligence, which is, however, quite distinct from reason. Were it otherwise, according to Mr. Darwin's own principles, ants ought long since to have been evolved into a much higher grade in the scale of existence. But, in reality, there is nothing extraordinary in the mental qualifications of the ant in the line of reasoning power. It throws up its hills and brings out its eggs into the sun on the same spot from which they have been swept away in the gravel walk the previous day. Go on destroying them, as the gardener must, for twenty years, the creature cannot reason upon the fact. Its instinct tells it that the eggs must be carried out into the sun. Had it reasoning power, it would gain by *comparing*, by experience, in fact, and would carefully avoid those spots where the nests had been so ruthlessly destroyed before. All the stories about aphides being treated as milch cows are myths, the result of inaccurate observation.

Again, take the spider. Watch a young spider spin its web, and you will observe as great an amount of reason-like intelligence and instinct as you do in the ant. Were the spider's web to be built by a reasoning animal it could not be more correct in mechanical principle. It is trifling with one's credulity to say that the young spider has been taught by its parents to fix its points of support, throw out its radii of lines from the centre of the web, and then form a net by making a series of eccentric circles, all of the same distance from each other. Well, if not taught, this structure *must* have been formed by *instinct*, and that *instinct must* be guided by a reasoning power exterior to the animal. Therefore I say Professor Owen was perfectly right in separating man from all other animals, and placing him in a kingdom by himself, although Mr. Darwin says the grounds upon which his classification is based have 'not been accepted, as far as I am aware, by any naturalist capable of forming an independent judgment.'

In a very able review of Mr. Darwin's 'Descent of Man,' in the 'Quarterly Review' for July 1871, the subject of instinct and reason is forcibly illustrated. I extract the following:—

'Altogether we may clearly distinguish at least six kinds of action to which the nervous system ministers:—

'1. That in which impressions received result in appropriate movements, without the intervention of sensation or thought, as in the cases of injury. (Reflex action.)

'2. That in which stimuli from without result in sensations, through the agency of which their due effects are wrought out. (Sensation.)

'3. That in which impressions received result in sensations which give rise to the observation of sensible objects. (Sensible perception.)

'4. That in which sensations and perceptions continue to coalesce, agglutinate, and combine in more or less complex aggregations, according to the laws of the association of sensible perception. (Association.)

'The above groups contain only indeliberate operations, consisting, as they do at the best, but of mere *presentative* sensible ideas, in no way implying any reflective or representative faculty. Such actions minister to and from instinct. Besides these we may distinguish two other kinds of mental action, viz.:—

'5. That in which sensations and sensible perceptions are reflected on by thoughts and recognised as our own, and we ourselves recognised by ourselves, as affected and perceiving. (Self-consciousness.)

'6. That in which we reflect upon our sensations or perceptions, and ask what they are and why they are? (Reason.)

'These two latter kind of actions are deliberate operations, performed, as they are, by means of representative ideas, implying the use of a *reflective representative faculty*.

'Such actions distinguish the *intellect*, or rational faculty. Now we assert that possession in perfection of all the first four (presentative) kinds of action by no means implies the possession of the last two (representative) kinds. All persons, we think, must admit the truth of the following proposition:—

'Two faculties are distinct, not in degree, but *in kind*, if we may possess the one in perfection without that fact implying that we possess the other also. Still more will this be the case if the two faculties tend to increase in an inverse ratio. Yet this is the distinction between the *instinctive* and the intellectual parts of man's nature.

'As to animals, we fully admit that they may possess all the first four groups of actions—that they may have, so to speak, mental images of sensible objects, combined in all degrees of complexity, as governed by the laws of association. We deny to them, on the other hand, the possession of the last two acts of mental action. We deny them, that is, the power of reflecting on their own existence, or of enquiring into the nature of objects and their causes. We deny that they know that they know, or know themselves in knowing. In other words, we deny them *Reason.*

'The possession of the presentative faculty in no way implies that of the reflective faculty; nor does any amount of direct operation imply the power of asking the reflective questions, before mentioned, as to "What" and "Why."'

Since the above was written, Professor Huxley has, in an article in the 'Contemporary Review,' treated the above remarks as 'eccentric' and unsound psychology and physiology. The able Reviewer is, I feel confident, quite able to answer Professor Huxley.

CHAPTER XV.

THE VARIATION AND NATURAL SELECTION ARGUMENT CONTINUED.

Catarhine and Platyrhine Monkeys.—Mr. Darwin's necessity for selecting the former in man's pedigree.—Structural difference in teeth, tails, and tendons.—Professor Owen on the dental differences of Monkeys and Man.—Teeth formed in reference to man's speech.—Microscopic structure.—Difference in Apes and Man.—Difficulties in Evolution and Natural Selection on this point insurmountable.—Mr. Darwin's twelve small and unimportant points of *resemblance* between Man and the higher Apes considered.—The teleological plan.—Fossil Monkeys.—Fourteen species known.—Bonnet Monkeys.—Apes.—Cebus.—Higher cranial development.—The so-called Anthropoidal Apes.—Human and monkey hair.—Man's descent from the Invertebrata.—Larva of Ascidian.—*Modus operandi* of God in Creation.—Reflections.

Mr. Darwin's reasons for selecting the old world or Catarhine group of monkeys as the ancestors of man, to the exclusion of the new world or Platyrhine group, would *à priori* require no explanation, for the latter would not suit his purpose at all, having an extra premolar and long tail to get rid of, which would rather have confused his calculation. Then, the old world monkeys, as their name implies (Catarhine) have a thinner septum between the nostrils, and therefore less matter to be evolved than the new world or Platyrhine, with their broad septa, would have had. In fact, the latter have evolved too much, too many premolars, too thick nasal septa, and tails altogether out of due proportion. 'Therefore, it would be against all probability to suppose that some ancient new world species had varied, and had thus produced a man-like creature, with all the distinctive characters proper to the old world division, losing at the same time all its own distinctive characters.' And 'therefore,' contends Mr. Darwin, 'there can *consequently*' (the italics are mine) 'hardly be a doubt that man is an offshoot from the old world Simian stem, and that, under a genealogical point of view, he must be classed with the Catarhine (thin nasal septa) division.'

The reader will at once see the force of the argument that Mr. Darwin would have had less difficulty as to structure to get over in adopting the old world monkeys as our ancestors, by reading the following table of the teeth in each group and in man:—

	Incisors.	Canines.	Premolars.	Molars.
New World Monkey (Platyrhine) .	8	4	12	12
Old World Monkeys (Catarhine) .	8	4	8	12
Man	8	4	8	12

Thus the new world monkeys have four more teeth than the old, or than man. But the little well-known marmoset, which is a new world Platyrhine, has the same number of teeth as the Catarhines and man, only they are arranged differently, thus:—

Incisors.	Canines.	Premolars.	Molars.
8	4	12	8

having four true molars less than its congeners. The tendons of the hands, as shown by Professor Haughton, are distinctly and structurally different in the old and new world monkeys: see his illustration in 'Lectures on Least Action.' But let us take Mr. Darwin's line for the present, viz., the Catarhine or old world monkeys, and note, although the teeth are similar in number, what difference they exhibit in form and microscopical structure.

It must not be assumed that because the teeth in man are the same in *number* as those of the old world monkeys, that they are necessarily in other respects like them. They differ remarkably, and so do the teeth of numbers of mammals, some of them low down in the scale, who have the same number of teeth as man; their nearest allies having many less. The monkey's teeth are not placed regularly, like those in the human subject, and there is an interval between the upper incisors and the canine teeth. The monkey's teeth have proportionately larger incisors, and some are longer than others; while in the human subject the canines are on the same level as the others. Both premolars and molars are proportionately smaller in man, while the crowns of the true molars are longer in proportion to the jaws and also to the bicuspids, canines, and incisors. Professor Owen, to whose classical work on 'Odontography' I am indebted for these remarks, selects the deciduous or milk teeth of the orang, chimpanzee, and man, and points out the salient difference between them. I must refer the reader to this work for more extended information. I will content myself with quoting here the deductions which he drew from the examination:—

'The differences brought out by the foregoing comparisons, though less striking than those exhibited by the permanent teeth, will be appreciated by the philosophical anatomist as yielding more certain evidence of the essential distinctions of the bimanous species; he will perceive that they are not due to mere adaptive developments, but are manifested at a period when the subjects of comparison are far from having attained the pre-ordained term of deviation from the common primordial type; and antecedent to those changes in the dental system itself, which more broadly characterise the species, and in the orang and chimpanzee proceed further to mark the different sexes.'[1]

The teeth of the human subject differ also from the anthropoid ape in the order of progression of the permanent teeth. Then, the teeth of man are peculiarly formed in reference to his speech, as is more especially shown by the adaptation of the incisors to the vertical symphysis; and this is accompanied 'in the highest races with a prominence of the lower border, forming the chin, which is *wanting in every inferior animal.*'

The microscopic structure of the human teeth differs from that of the highest apes, in the following characters:—

[1] *Op. cit.* p. 54.

1. The calcigenous tubes describe the same primary curvatures, but more strongly; and the secondary gyrations are shorter, and more strongly marked. They are not so closely arranged, nor so numerous, nor so straight in the human subject as in the ape.

2. The enamel fibres are more wavy and longer, in the proportion of $\frac{1}{5000}$ part of an inch thickness in man, to $\frac{1}{6000}$ in the ape.

3. The tubuli of the cement—that portion of the structure of teeth which is thickest over the fangs—are $\frac{25}{1000}$ parts of an inch in diameter in apes, and only $\frac{20}{1000}$ parts of an inch in man.'

And other differences the reader will find in the 'Odontography.'

In the manner in which the enamel covering to teeth is disposed, a beautiful instance of the 'least action' principle is shown. 'Every fibre of enamel,' says Professor Owen, 'is so disposed by the preliminary disposition of the cells in which it was moulded as to give it the utmost strength and power of resistance of which such a tissue could be capable. The polished surface, the pearl-white colour of this dense and brittle substance, adds ornament to use. In the second and principal substance of the tooth, the dentine, we have traced an equally beautiful arrangement of the earthy salts in directions which best resist both vertical and lateral pressure, but with the additional economy of the substitution of the hollow column for the solid prism.'

In the outset of his argument, therefore, Mr. Darwin is met by an insurmountable objection, in the difference between the teeth of the Catarhine monkeys and man. No wearing away or shrinking of canines from disease will give him that alteration in the structure of each individual tooth; that difference in shape and of size; the change from the tearing teeth of the animal which has no knowledge of fire or of cooking its food—or of the howling monkey—to the articulating and speaking man. No known law of evolution, or of natural selection, or of correlation, will help him in the slightest degree over this one only in ten thousand difficulties which he must face and conquer before he can transmute a monkey into a man.[1]

Mr. Darwin, at p. 191, observes upon the 'small and unimportant points of resemblance between man and the higher apes':—

1. Relative position of features.
2. Various emotions, as displayed by the use of similar muscles.
3. Similarity of external ears.
4. The commencement of 'hook noses' in the Hoolock Gibbon.

[1] Professor Huxley, in his paper in the *Contemporary*, says: 'We know that for every bone, muscle, tooth, and pattern of tooth in man, there is a corresponding bone, muscle, tooth, and pattern of tooth in an ape.' But why say this of the monkey, merely because he is the assumed animal from whom man has been evolved? A very nearly similar statement might have been made with equal truth about many mammals which are altogether left out of man's descent by Mr. Darwin.

5. Beards and whiskers.

6. Hair on head, which in the Bonnet monkey radiates from a point on the crown, with a parting down the middle as in man.

7. Abrupt termination of Bonnet monkey's hair, so as to display forehead of same.

8. Assertion that monkeys have no eyebrows untrue.

9. Eschricht, a writer in Müller's 'Archives,' says, that the limit between hairy scalps of children, of man, and naked forehead, is sometimes not well defined, being thus similar to conditions of Bonnet monkey.

10. Hair of man converges on arms to a point below elbows; so it does in gorilla, chimpanzee, orang, and some species of Hylobates, and even in some few American monkeys, from whom we are not descended.

11. Use of hair on back of most mammals adapted to throw off rain, and transverse hairs on forelegs of dog serve the same end; and Mr. Wallace says the like of orang.

12. Ergo, the hair 'on our forearms offers a curious record of our former state; for no one supposes that it is now of any use in throwing off the rain, nor in our *present erect condition is it properly directed for this purpose.*'

Directly after this last assertion, Mr. Darwin tells us 'it would be rash to trust too much to the principle of adaptation in regard to the direction of the hair in man or his early progenitors;' for Eschricht says that other and more complex causes have intervened, and 'he has shown some relation between the hair on the limbs and the course of the medullary artery.' Surely it was hardly worth while to put forward the 'adaptive' theory merely for the sake of allowing Eschricht to knock it down again.

Now, the above twelve 'small and unimportant points of resemblance between man and the higher apes' are by no means thought lightly of by Mr. Darwin; for he tells us, at pp. 189–90: 'in determining the position of man in the natural or genealogical system, the extreme development of his brain ought not to outweigh a multitude of resemblances in other less important or quite unimportant points.' Therefore we will look a little closely into them.

In the first place, what Mr. Darwin calls resemblances, he *assumes* are genealogical. I need hardly notice this in a work which is pre-eminently full of assumptions and of that peculiar kind of logic which reasons out its conclusions upon bases which are not proved. As I have before remarked, but which Mr. Darwin's mode of reasoning obliges me over and over again to reiterate, the Creator has formed all the animals in the world upon different plans. The vertebrate plan, as the one we have more particularly to deal with, is clear and unmistakable. The fish is formed for living in water; the reptile is organised and formed for an exceptional existence, viz., its peculiar sluggish life, and its necessity for hybernating, when its peculiar food does not exist. But the muscles which move the limbs of the frog are similar to those which effect the same movements in man; the blood which circulates in its veins nutrifies the muscles, bones, and viscera, as it does in man. The nerves perform similar functions by similar means.

Is it philosophical to say that these similarities indicate genealogical lines of descent? The bird moves through the air by mechanical means, adopted upon mathematical laws almost too high for the reason of man to unravel, and much too high for him thoroughly to understand or to imitate. How utterly groundless, then, is it to say that parts which are, for the sake of scientific investigation, termed homological between man and the bird, indicate genealogical descent!

Still more apparent is the absurdity of carrying out this mode of reasoning in the great mammalian sub-kingdom, where functions still more like require still more similar means to perform them. No one doubts the resemblance in many respects of the physical structure of monkeys and men. Are we to jump to the conclusion that *therefore* the latter have been evolved from the former? In the Miocene geological epoch—in which the vegetation of the world was of the grandest character, when plants flourished which are only found now in temperate or tropical climates—monkeys are known to have existed; at least three forms have been discovered—the remains of a large and small gibbon, and a well-developed semnopithecus have been found. These three monkeys belong to the Catarhine or old world group, but *not* to the higher anthropomorphic apes, the gibbon being at the bottom of this class, and the semnopithecus not in it at all. But we have no evidence of man in the Miocene period. In the next great change in the geological era, the climates of the world were altered, by the permanent accumulation of ice in the Arctic circle, and the separation of the connection by land of the old and the new worlds. But although at least fourteen different species of monkey have been found fossil, no vestiges of man, or an ape-like man, having lived in those ages have been discovered.

Instead of bringing forward arguments from the stone book, Mr. Darwin states that the relative position of a monkey's and man's features is similar—which I deny; that similar emotions are shown by the action of similar muscles, which must be true; that the ear-lobes of man and monkey are similar—admitted; that gibbons, though low down in anthropomorphicity, commenced hook noses, which reads like sheer nonsense; that some monkeys have beards and whiskers—so have goats; that the Bonnet monkey, which is not anthropomorphous, and has a long tail, first began to divide its hair in the middle of its head, like the dandies of the present day! that the said Bonnet monkey's hair recedes, so as to display the forehead. But this is certainly not the case with the anthropomorphous apes cited by Mr. Darwin; while the same thing may be observed in some members of the family Cebus, a new world Platyrhine group; while still further down, among those monkeys from which we 'are not descended,' we see in the pretty little Saimara a development of cranium greater than in the anthropomorphous apes!

It is not worth while noticing the supposed agreements in the disposition of human and monkey hair, inasmuch as Eschricht has discovered that the development of hair is 'somehow or other connected with the arteries of the spinal chord, and therefore not adaptive.' We may, on Mr. Darwin's authority, safely say that upon this subject we are at present profoundly ignorant.

Having satisfied himself that man is the direct descendant of apes—through an ape-like man—Mr. Darwin in the next place treats of his antiquity, and endeavours to find him a birthplace. He considers he has cleared the ground by forcing him upon the Catarhine group of monkeys; and has made it obvious that, when he first lost his hair, he lived in a hot country; and that he ate fruit; and that the probable date of his incoming was the Eocene or most ancient of the tertiary formations. And as he thinks there is nothing in the geological break, he asks us to imagine that an ape-like man became evolved in the lower tertiaries, the remains of which, or of his descendants, have never been discovered. Such a demand upon the credulity of mankind was never, I believe, before seriously made, unless when we were told that geese were transmuted barnacles.

Mr. Darwin, quite satisfied that he has established his case, now goes on to trace man's genealogy lower down. From the monkey we are taken to the Lemuridæ, because the group stands below and is closely allied to the Simiadæ; and from the Lemuridæ we are carried to the kangaroo; and from this dignified beast to the duck-billed platypus, which, with the Echidnæ, he thinks are the relics of a much larger group, the rest being extinct.

Below the Mammalia Mr. Darwin becomes 'involved' in difficulty, and throws us upon the wild, unsupported opinions of Professor Häkel; he then modestly hints that as the duck-billed platypus, our respected ancestor, is closely allied to reptiles, that the dinosaurus may have connected us through the birds with the duck-bill, and then on to the reptiles. From the reptile, *facilis descensus*, he shoots us, through ichthyosaurus and lepidosiren, to the ganoid fishes, when our ancestors swam in proud majesty in the waters of the sea. From the fishes he traces us positively to the lancelet or amphioxus, a fish-like vertebrate, said to be closely connected with the ascidian mollusc — a 'simple tough leathery sac, with two small projecting orifices'—classed by Huxley and others among the Molluscoida, below the Mollusca; and in this leathery bottle he finds some small larvæ, which Kowalevsky of Naples declares pass through similar changes to the Vertebrata. Therefore, notwithstanding Kowalevsky's anatomical statements have been denied, here, in a leathern bottle, with two openings, in true Darwinian style, he points out the creature which, in remote time, varied in two directions: one, retrogradingly, down to the ascidian mollusc; the other, upwards, to the Vertebrata—being, in fact, man's earliest known ancestor on earth. I say that Kowalevsky's supposed discoveries in the larvæ of the ascidian have been disproved; of which more anon.[1]

With regard to the larva of the ascidian, to which one looks with renewed interest, the late M. Moquin-Tandon, in his 'Le Monde de la Mer,' has the following description. The reader must bear in mind that the parent ascidian is fixed, and never able to move from the spot to which it is attached. 'The larvæ of the Ascidiæ are of course not fixed. They are not unlike tadpoles, having large heads and short tails. Swimming away from their parent as soon as they are born for some little time, they give way to a roving propensity; but the chains of instinct are about them, and in due time they settle down in life. This, however strange it may appear, seems contrary to their inclination; for, on watching the process of their transformation, it has been observed that the larva,

[1] For a further specimen of this investigator's mistakes, let me refer the reader to the *Proceedings of the Zoological Society*, 1871, par i. p. 12.

having placed its head against a rock or any solid body—doubtless directed by instinct, but probably unprepared for the result—becomes fixed. This is the sign for the metamorphosis to commence. The head enlarges and grows hollow; the tail—if we may be allowed the expression—is flourished in the air; but soon the flourishes give evident tokens of anything but pleasure, for the motion grows so rapid that it becomes difficult to see the tail. The struggles of the little creature are perfectly frantic; but all effort is useless; it is, in fact, bound prisoner for life, and in time, ceasing its vain endeavours, it resigns itself to its fate. The tail drops off; a thick coating grows around it; rootlets spread like anchors from the part by which it is attached and completely fix it; and thus, forgetting the roving propensities of its youth, the bichus settles down and becomes a staid member of marine society.'[1]

Such was our ancestor's retrograded analogue. Some points of his history—such as running his head against a wall, and 'settling down' after a roving life—have a human parallel certainly; but why did the poor larva vary so as to be degraded into an ascidian? Mr. Darwin's hypothesis is certainly very accommodating.

Now, I will not, for reasons before stated, touch

[1] *The World of the Sea*, translated by the Rev. H. Martyn Hart, p. 185. Figures of the larva and its transformations are given further on (fig. 6).

upon the religious questions which rise up in the mind when we have followed Mr. Darwin to this point. Such mode of argument, however potent, is made use of by his disciples to disparage the criticisms of science. Their case is really so weak, that they gladly seize hold of any opportunity of diverging from the point at issue, at the expense of their antagonists' scientific reputation.

As far as I am concerned, I would gladly accept any sound explanation of the *modus operandi* of God in Creation. My own opinion is that such knowledge is beyond the limits of human reason. That as we cannot realise a spiritual existence because we cannot compare it, so do I believe that the operations of Divinity are incomparable, and consequently that we cannot realise with our limited reason the incoming of species into the world. I place the grand event of man's existence in the world in the same category of thought as the termination of space, the beginning and end of time, the indivisibility of matter, and the true nature of gravitation; and while I admit and cherish the most extreme and recondite investigations into the hidden mysteries of nature, I deny the right of any man to deal with such questions upon mere assumptions, illogical bases, and unsound deductions. 'The system of Darwin is eminently illogical, and must fall.' It is an hypothesis which draws large but unsound deductions from the rare and abnormal deviations, leaving the real field untouched and unexplored. It is founded upon the exceptions, not the rules, of nature. It is utterly opposed to design, to the teachings of animal mechanics, to the grand and beautiful and everlasting proofs upon which the teleologist loves to dwell. It is a cold, unsound, unphilosophic, degrading system of assumed probabilities, which, if true, would be ten times more wonderful than anything assumed or believed by the most strict and rigid disciple of special creation. Nay, still further, if proved in every point to be true, it would still leave the fact of special creation in all its wonderful mystery. The organic cannot be formed from the inorganic; nor could the organic, if it were so formed, be endowed by any physical force with the laws and properties of LIFE. Go on still in speculation, and I ask, whence the inorganic—its beginning, its ending, its grand and inexplicable laws—which the physicist in vain attempts to correlate with the vital? whence gravitation, and what? the sidereal system, and its movements? the SPIRIT, that breathes through illimitable space, and lives through an eternity of time?

The very grandeur of the subject, too vast to contemplate, would be a sufficient answer to the puny efforts of man to solve the great problem and mystery of existence; while the mathematical certainty attached to all that is known of astronomy makes it quite certain that the details of life on one speck of the universe are not left to mere chance, or the destruction of the weak by the strong, resulting in what is termed the 'survival of the fittest.' The chance operation of force in the production of abnormities in nature is distinctly answered by the fact that all force is guided. The earth, as is beautifully expressed by Professor Haughton, is a geometer, because she forms within her the five typical geometrical forms which a geometrician alone could make.[1] The animal frame is formed upon a plan which is altered to suit circumstances of existence, and is brought into being by the Power which directs the forces of nature. How, man is not permitted to know, inasmuch as his intellect is limited. His reason cannot solve mysteries which by their very nature it cannot compare. The finite can only reason out the infinite by inductions drawn from its own incompetency. Meanwhile, let us remember that the deep investigations of a truly philosophic mind will be directed rather in unfolding the productions of nature than in dogmatising upon the 'how' and the 'why' such productions are formed. Take away from our studies the charm that this 'how' and this 'why' are the workings of a Power which is reasoning, adaptive, infinite in knowledge, in power and in existence, and science becomes a dark, repulsive pursuit, which must end in its own destruction and the extinction of all theistical belief.

[1] *Vide* p. 36, *ante*.

CHAPTER XVI.

THE VARIATION AND NATURAL SELECTION ARGUMENT CONTINUED.

Sexual selection.—Battles of Males.—Law of Battle that of Nature, not sexual selection.—Numerical proportion of sexes.—Polygamy.—Modifications of Male.—Laws of inheritance.—No Sexual Selection in Lower Invertebrata.—Why, then, have they brilliant colours?—Wings of Insects.—Feathers of Birds.—Sea Slugs.—American Maple.—Mollusca.—Worms.—Crustacea.—Arachnida.—Myriapoda.—Insects, viz.: Thysanoura, Diptera, Hemiptera, Homoptera, Orthoptera, Neuroptera, Hymenoptera, Coleoptera.

THERE is no part of Mr. Darwin's theory more untenable than that which he terms 'Selection in relation to Sex.' This subject occupies a greater part of the two volumes on the 'Descent of Man.' It may be shortly defined as the evolution of colour, ornament, or other differences in structure under the influence of sexual selection—such colour, ornament, or difference in structure giving the male a superiority over other males, and hence their elimination by natural selection.

Now, it is obvious at a glance that the above advantages assigned to the male in the struggle for existence must have been *accidental* in the first instance, and become intensified afterwards by inheritance. Were such colours pre-ordained when the animal was created, it is obvious the doctrine of sexual selection could not stand; for, to assert that the female's influence in producing changes was pre-ordained would be to destroy at once any power she might possess. The doctrine, in fact, makes the taste of a hen for the gaudy colour of a feather in a cock's tail an influence greater in biological development than design. In short, sexual selection may be taken as a type of Darwinism in all its phases. It puts an end at once and for ever to all the absurd but well-meaning attempts to reconcile his philosophy with teleological belief.

To do Mr. Darwin justice, he does not himself attempt anything so puerile and weak. He states his belief boldly, and he carries out his arguments and investigates his theories with an earnestness and clearness which exclude at once any possibility of confliction between the two doctrines.

With these few remarks, I proceed at once to discuss the question and examine the various cases in support of the argument adduced by Mr. Darwin.

Mr. Darwin commences his subject by dwelling upon the fact that the males of many species of animals periodically fight with other males for the possession of the female. Granted. But how does this support sexual selection? It merely proves that there is no such selection at all, but that the males fight it out, and that the females must submit to the conquerors. I hold that this law is more or less universal, and is the true explanation of the subject. Mr. Darwin says it is not so in a 'multitude of cases.' Again we see he has recourse to the 'exceptional.' This 'multitude' of males 'do not obtain possession of the females independently of choice on the part of the latter.' And then comes the extraordinary statement: 'The courtship of animals is by no means so simple and short an affair as might be thought. The females are most excited by or prefer pairing with the more ornamented males, or those which are the best songsters or play the best antics.'

Now, let us examine the question under Mr. Darwin's own headings.

1. *Numerical proportion of the two sexes.*—With most of our domestic animals, Mr. Darwin says, the sexes are nearly equal at birth. The *greatest inequality* is with greyhounds, which had, in 6,878 births, 110·1 males to 100 females. At *maturity*, Mr. Darwin says, from facts he has collected, 'the males of some few mammals, of many birds, and of some fishes and insects, considerably exceed the females in number.'

2. *Polygamy.*—Mr. Darwin gives a list of all animals that are polygamous; and he says that in birds there often exists a close relation between polygamy and the development of strongly marked sexual characters. Every ornithologist knows that no

rule can be drawn upon this subject, and it signally fails with birds which we are accustomed to as British, a long list of which might be drawn up—such as golden oriole, chaffinch, bullfinch, goldfinch, greenfinch, redstart, bearded tit, blackcap, lesser spotted woodpecker, shrike, Steller's duck, goosander, merganser, teal, garganey, night heron—all of which, and many others, differ in sexual plumage, and yet are strictly monogamous.

3. *The male is generally more modified than the female.*—Granted. But Mr. Darwin says this is owing to the fact of their having stronger passions than the female, which leads them to fight for her; and the conqueror, being accepted, transmits his superior qualities to the other *males* his descendants! This idea is supported by such arguments as the following:—'The males of various lowly-organised animals having thus *aboriginally* acquired the *habit* of approaching and seeking the females, the same *habit* would naturally be transmitted to their more highly-developed male descendants; *and in order that they should become efficient seekers,* they would have to *be endowed with strong passions.* The *acquirement* of *such passions* would naturally follow from the *more eager males* having a larger number of offspring than the *less eager.*' And then, without telling us what caused the eagerness of the males that left such *eager offspring,* Mr. Darwin remarks, *more suo*: 'The great eagerness of the male has thus indirectly led to the much more frequent development of secondary sexual character in the male than in the female!'

It is impossible to admit such reasoning as this in a biological discussion. The question as to the greater eagerness of the male than the female is, to say the least of it, 'unproven;' but when it is asserted that such eagerness causes peculiar masculine characters to become more highly developed and propagated to offspring, we are asked to stretch our credulity to its utmost limits.

4. *Laws of inheritance.*—This subject is treated of as occurring at 'corresponding periods of life,' proofs of which are shown by the chicks of the common fowl differing from each other whilst covered with down, in their first true plumage, and in their adult plumage. Therefore, in comes the Darwinian dogma, that in the breed of spangled Hamburgs, 'variations have occurred, and have been transmitted at three distinct periods of life!'

Inheritance at corresponding seasons of the year is shown by the horns of the stag, the fur of arctic animals, numerous birds acquiring bright colours during the breeding season; therefore, such changes were inherited *because* the animals originally varied in the horns, fur, and bright feathers at those particular seasons!

Inheritance as limited by sex.—Characters are not rarely transferred exclusively to that sex in which they first appeared, *because* there are breeds of goats and sheep in which the horns of the male differ greatly from the female. Tortoiseshell cats are so coloured, as a rule, only in the males. In most breeds of fowls each sex has its proper dress transmitted. Domestic pigeons, differing from wild ones, sometimes have sexual differences, especially in the way of wattles; but the cause of such differences Mr. Darwin cannot even conjecture. (P. 285.) He, however, lays down a rule, that 'variations which first appear in either sex at a late period of life tend to be developed in the same sex alone; whilst variations which first appear early in life in either sex tend to be developed in both sexes.'

Mr. Darwin occupies many pages upon this subject, which he considers important to his doctrine of sexual selection; but it is not necessary to follow him into those details.

In passing up the animal scale, Mr. Darwin notices that in the Protozoa, Cœlenterata, Echinodermata, and Scolecidæ, there are no true secondary sexual characters. The Ascidians, degenerate descendants of our ancestors, are hermaphrodite, and therefore they could not have acquired secondary sexual characters. But how about the sea-anemones, jelly-fish, medusæ, star-fish, echini, &c.? Some of them, unlike our ascidian, have great and splendid coloration. Being of a lowly character, and having 'low mental powers, Mr. Darwin does not believe, whether hermaphrodite or not, that 'such colours do not serve as a sexual attraction, and have not been acquired through sexual selection.'

Well, this may be a convenient way of getting rid of a difficulty, but I will just remind Mr. Darwin that many of the sea-anemone family build as residences some of the most exquisite structures in the world; and, whether this is done by instinct or intelligence, the power is still mental. Why, then, I ask, are the beautiful scarlet, green, yellow, blue, emerald, silver, golden-hued, lowly coral animals given such splendid colours? Mr. Darwin answers that their colours appear to be 'the direct result either of the chemical nature or the minute structure of their tissues, independently of any benefit thus derived.' Exactly so. But let me ask how are the beautiful wings of insects or the feathers of birds produced. Mr. Darwin's answer will equally apply to them. These colours are produced, say in a feather, either by the deposit of a pigment derived from the food in the cells of the feather, or by a beautiful series of striæ, mechanically sculptured upon the ultimate plumule by *nature*, just as the same kind of striæ give the metallic hues of some metals, as bismuth, and which is artistically copied by the manufacturer of 'shot silk' dresses. And are we, in the nineteenth century, to be coolly and deliberately told, as the utmost result of scientific research, that a great class of animals which live at the bottom of the sea—some never having been seen by man for thousands of years—have their gorgeous colouring as the result of chemical changes, which is of no use to them; while the higher animals gain it by gradual changes in past generations, just to please an amorous she-butterfly or a luxurious tom-tit?

Again, look at the beautiful Eolidæ, or sea-slugs, creatures much higher in the world than our early parent, the molluscoid ascidian-like larva. Can anything be more gorgeous or beautiful than these slugs? But because Mr. Hancock says the colour is produced by the depôsit of biliary pigment, therefore it has not the same use as in a bird's wing, though a similar pigment gives it its beauty! And then Mr. Darwin, with that cold utilitarian spirit which marks the whole of his writings, says: 'The tints of the decaying leaves in an American forest are described by everyone as gorgeous, yet no one supposes that these tints are of the least advantage to the trees.' Granted. But they have a use. They are part of the glories of God's universe. They awaken in the mind of God's creatures feelings which lead thoughtful and intelligent men to carry their contemplations of the beautiful from the created to the Creator. These leaves are as gems of gold or precious stones in the eyes and to the perceptions of the student of art and of nature; they are the ornaments of God's handiwork—in the world wherein He has placed the gifted beings formed in *His* own image.

Mr. Darwin appears to be insensible to the true grandeur of the works of nature; it pleases him better to fix all beauty in the world as the direct result of thought, or action, or deed which belong not to the intellectual or higher, but to the sensuous part of our animal condition.

Mollusca.—Here, again, Mr. Darwin's difficulties crowd upon him. What objects are more beautiful than the rich yet delicate colours of our *shells?* but the gasteropods have not mental powers enough for 'members of the same sex to struggle together in rivalry.' And in the same paragraph in which he makes this remark about some of the most beautiful structures in the world, he admits, and quotes Agassiz to support him, that plain unornamented black slugs do actually court each other!

Worms (sub-kingdom *Annulosa*) also contain many gorgeous and beautiful creatures; but, as Mr. Darwin says, 'too low in the scale for the individuals of either sex to exert any choice in selecting a partner, or for the individuals of the same sex to struggle together in rivalry;' and therefore he leaves the worms

To waste their sweetness on the desert air.

Arthropoda (class *Crustacea*).—Here Mr. Darwin finds for the first time 'undoubted secondary sexual characters, often developed in a remarkable manner.' Crabs and lobsters have more intellect than slugs and worms, and therefore are more capable of appreciating in a sensuous way gorgeous colouring or more fascinating claws; therefore sexual selection has given the male, according to Darwin, an increased number of smelling threads, by which he is able to smell out the female. Fritz Müller, a warm disciple of Darwin, has discovered a species of Tanais in which the male occurs in two forms. One form has more smelling threads, and therefore smells out the female sooner; but the other fellow has more powerful pincers, so that he can hold the female tighter, and beat his conqueror all to nothing. Of course the superior smeller is doomed to extinction, upon Darwinian principles.

Mr. Darwin is puzzled by the difference in size of lobsters' claws; for, though the great size of one leg might give him a better advantage in fighting, still this will not account for the female having the same inequality.

Fritz Müller comes to the fore again with another strange crustacean, which he has called *Orchestia Darwinii,* and which Mr. Darwin figures. Here the males differ also in the size of chelæ or pincers. Mr. Darwin thinks they both derived equal advantages from their pincers in holding the females; therefore an equal number of each was propagated and sent down to posterity—thus baulking natural selection of its prey.

Mr. Darwin thinks rather highly of the mental faculties of the Crustacea, for he says it is very difficult to catch a shore-crab; and there is one which lives on coral islands (*Birgus latro*) which makes a nest of cocoa-nut fibre. Another was seen by a Mr. Gardner, in Brazil, making a burrow; and that gentleman threw some shells near the hole, which the crab removed, and hence placed the family in a much higher mental condition; which is quite in accordance with the Darwinian rule, that such an improved mental state is necessary to induce secondary sexual characters. As to colour, there is only one instance in which Mr. Darwin thinks it was produced as a blandishment for the female, and that is a Gelasimus, found by the indefatigable Fritz Müller, in which the shell of the female is nearly uniform greyish-brown; but in the male the cephalo-thorax is posteriorly white, with the anterior part of a rich green. These characters Mr. Darwin thinks have been acquired to 'attract or excite the female!'

Arachnida or (*Spiders*).—There can be no doubt about the increased mental qualities of the spider. He is a much more intelligent fellow than either the lobster or crab, and builds a web displaying the highest architectural and mechanical abilities. The sexes do differ in colour sometimes, but, on the whole, Mr. Darwin has not much to say for spiders in the way of sexual selection. In fact, the females having it all their own way, are often more gaily coloured than the males—the latter of whom have often to take care what they are about, as the celebrated De Geer actually saw with horror a male spider cautiously approach a female, on amorous thoughts intent, when the latter coolly seized him with her legs, folded him in web, and then sucked the juices out of his unfortunate body. But there is no reason, as far as I can see, if there is anything in the theory at all, why the females should not vary and adopt colours expressive of their non-ferocious nature; for, of course, those who had the male-eating propensity developed least would be propagated and increased by natural selection.

The intercourse between the sexes in spiders has not been satisfactorily described. I witnessed the following in a web of one of the Epeiridæ last autumn. A female appeared to be narrowly watched by two or three males. One of the latter advanced cautiously, and when about an inch from the female made a dart, and a struggle took place. All was then quiet, and I thought one cannibal was devouring the other. Not so, however. In about a minute they separated, and the male took a walk round the web. In about three minutes he returned to the charge, and the same scene was enacted. In a minute more he walked off to a corner of the web. Seeing the ground clear, male number two appeared upon the scene, and the same meeting took place, with the difference that after the first embrace the female marched off into her corner, and was no more seen.

We have arrived now at the first instance of 'stridulation' as a means of connubial communication, one Westring having recorded the fact that several species of spiders belonging to the genus Theridion have this power. In fairness, however, I think we ought to note the first instance recorded of cannibalism, and to suggest to Mr. Darwin whether he would not reconsider the subject, and place spiders in the human pedigree, based upon this fact.

In the *Myriapoda*, Mr. Darwin can find no well-marked instance of sexual difference likely to influence the choice of the female.

Insects.—Mr. Darwin devotes upwards of eighty pages, in two chapters, to the sexual character of insects.

(*a*) In the *Thysanoura* there is no sexual distinction, but we have the authority of Sir J. Lubbock that the male and female coquet with each other; so that in a creature so 'small, wingless, and ugly,' perhaps future observation may lead to some discovery among them, as they are evidently courteous to each other, and civilised beyond their position.

(*b*) *Diptera.*—This large class is no help to Mr. Darwin, as the sexes differ but little in colour. In one genus, Elaphomyia, discovered by Mr. Wallace in New Guinea, the males are furnished with horns, which in one species are as long as the creature's body; but as 'they are of a beautiful pink colour edged with black, with a pale central stripe, and as these insects have altogether a very elegant appearance, it is perhaps more probable that the horns serve as ornaments.' But the males of the Diptera, except Harry Long-legs, as recorded by Westwood, do not fight for the female. Therefore Mr. Darwin for once accepts ornamentation, and devotes only half a page to the largest group of insects! It is very candid of Mr. Darwin, who is one of the most conscientious of writers, to have mentioned the Elaphomyia at all; how much more candid it would have been had he here 'given up' the *ignis fatuus* which he calls sexual selection.

(*c*) *Hemiptera* are no help to sexual selection, although the splendid colours of some field-bugs are well known to entomologists. I suppose female bugs have not sufficient intellect to be charmed with one bug more brilliant than another.

(*d*) *Homoptera.*—The song of the cicadas will live for ever, thanks to the poets. Mr. Darwin quotes Dr. Hartmann in proof that such song, or rather drumming—for the noise is produced by vibration of the lips of the spiracles—is a 'marital summons from the male,' and it appears this drumming goes on by a number of males one against the other; and Mr. Darwin thinks it 'probable' that the females 'are excited or allured by the male with the most *attractive voice.*' This, of course, is a *lapsus calami* for *attractive drum,* inasmuch as the noise is not caused by voice at all; and as it is described as 'clanging' by Dr. Hartmann, I should think the female must be highly endowed mentally to distinguish the charms of the successful wooer.

(*e*) *Orthoptera.*—Crickets and locusts and grasshoppers are a musical group, but the sounds are produced differently in the three families; and Mr. Darwin has given excellent figures of the beautiful structures by which they are produced. Instead, however, of attributing these inimitable proofs of design and adaptation to their true cause, he talks of their being due 'to the whole organisation undergoing in the course of ages multifarious changes;' while in the same paragraph he suggests that they have had plenty of time to do it in, since 'Dr. Scudder has found a fossil insect in the Devonian formation of New Brunswick, which is furnished with the well-known tympanum or stridulating apparatus of the male Locustidæ. This is a specimen of the manner in which Mr. Darwin attempts to make facts most crushing to his theory arguments in its favour. The Devonian system, I may say to the non-geological reader, is at the bottom of the great secondary series of strata, and the time must have been so immense since its deposit that the human mind cannot realise it. And yet in that remote age we find an insect with its 'drumming apparatus' perfect, associated with fishes and other animals representing the five great divisions observed in the present day. Through eons of time this insect and its congeners have lived and died, impressed with characters with which they were created, and adapted to an existence which in all times is proved by this discovery to have been the same.

(*f*) *The Neuroptera.*—Mr. Darwin does not believe that the splendid colours of the Ephemeridæ in this class are given to attract the female; but among the dragon-flies, notwithstanding, the males and females are often both most brilliantly coloured, and he adduces as tending towards a proof that they are attracted by colours, that one Patterson actually saw dragon-flies which were blue themselves settle on the blue float of a fishing-line! whilst two other species 'were attracted by shining white colours.'

Such is the style of argument by which the doctrine that brilliant colours in males are produced by the preference to them of the female is supported!

(*g*) *Hymenoptera.*—Well, we have now got to the most intelligent of insects. Surely an insect so pugnacious as to fight other 'tribes' in armies regularly led by officers, who keep milk-cows, 'build great edifices,' 'make roads' and 'tunnels under rivers,' &c., as the ant does, ought to have given some evidence in support of 'sexual selection.' The great tribe of gorgeously coloured bees, and wasps, and hornets, ought not to have been entirely unproductive in the exercise to which Mr. Darwin endeavours to give the certainty of a law. And yet so it is. Mr. Walsh says the ichneumons differ in colour sexually. Mr. Smith says several ants differ similarly, and Anthophora is quoted to prove that the male is brown and the female yellow; while Australia adds its facts, inasmuch as the male of *Lestis bombylans* is 'brassy' and the female brilliant steel-blue, tinted with green; but it won't do—the females having stings do not want protection, and therefore do not differ from males; and both sexes of *Mutilla Europæa* emit a stridulating noise. But it is all of no use; this great and most intelligent group of insects offer no proof in favour of sexual selection.

(*h*) *Coleoptera* (*Beetles*). — Many are beautifully coloured. But as Mr. Darwin sees no *use* in beauty, he has a 'suspicion' that these colours serve as sexual attractions; still, as the sexes rarely differ in colour he only indulges in suspicion. Of course, this is another strong proof against him, for a law of such magnitude as that of sexual selection ought to be universal—nay, the argument is against him on his own ground, for in the few Longicorns which sexually do differ in colour—especially Esmeralda, where the difference is so great as to have caused their being considered different species—the difference in splendour is on the side of the female. Therefore, 'this does not accord with the common rule in regard to colour, when acquired through sexual selection.'

Why then, I ask, may not all sexual difference of colour be gained in the same way as it is in the Longicorn beetles, viz. for ornamentation, which is a grand and universal attribute of creative energy? To tell me that differentiation takes place through myriads or eons of time in order to perfect the carapace of a crab, or please the sensuality of a beetle, is asking me to believe that which I know, and which every student of nature as nature knows, is impossible. The works of creation are, and have been through all time, perfect, and adapted by a thinking and reasoning Mind to the purposes for which they were created.

Mr. Darwin can never upset this great truth by any amount of writing with the intention of showing that the works of nature have always been transitional and imperfect.

This, his great canon, is totally unsupported, either by probability or fact. It does not meet the case at all to tell us that things are *created* by the slow accumulation of inherited variations, and therefore the end and aim is equally attained by Darwin's hypothesis as by any other mode of creation. *This is not so.*

Take, for instance, the stridulating organs found, as above stated, in the Devonian rocks, and which do not differ from those observed in insects in the present day. Is not that vast time permanence enough? Is it not positive proof that species are permanent? No, says Mr. Darwin, you must give me eons upon eons of time before the Devonian in which the sexual agencies of the female insect have been operating to produce these stridulating organs! He gives the following account of the diversified forms of stridulating organs in the Coleoptera. 'This diversity is intelligible if we suppose that originally various species made a shuffling or hissing noise by the rubbing together of the hard and rough parts of their bodies, which were in contact; and that from the noise thus produced being in some way useful, the rough surfaces were gradually developed into regular stridulating organs.' This stridulation, however, it appears, is common to both sexes, with some few exceptions; therefore it cannot have a sexual use. However, Mr. Darwin will have it so, for he says doubtless the 'shuffling noise' above mentioned would serve to bring the sexes together, 'and that as the males or females which made the greatest noise succeeded best in finding partners, the rugosities on various parts of their bodies were gradually developed by means of sexual selection into true stridulating organs!!'

Many beetles have large horns, like the male of our well-known stag-beetle. It does not appear, however, that, in the tropical species, Copris, Phanæus, Dipelicus, Onthophagus, &c., Mr. Bates could ever detect the males fighting, although the horns are most curious and varied in these species. Mr. Darwin, therefore, comes to the conclusion that these singular appendages have been acquired as ornament.

One Lamellicorn—Lethrus—does fight, and so does our stag-beetle; the former has no horns like the latter. But the stag-beetle does not, it appears, fight with horns, for Mr. Davis 'enclosed two males with one female in a box; the larger male severely *pinched* the smaller one until he resigned his pretensions.'

In fact, horns here do not at all meet the Darwinian requirements for sexual selection, and, therefore, even the horns of the stag-beetle, Mr. Darwin thinks, are provided more for ornament than use. (Vol. i. p. 377.)

But 'sexual selection implies the possession of considerable perceptive power and of strong passions,' and does, according to Mr. Darwin, 'seem to have made some way with the Lamellicorn beetles, though utterly inoperative with the intelligent ant, or the cell-making bee, or the spider.'

Some Lamellicorns 'are provided with weapons for fighting, some live in pairs and show mutual affection, many have the power of stridulating when excited, many are furnished with the most extraordinary horns, *appurently for the sake of ornament*; some, which are diurnal in their habits, *are gorgeously coloured*; and, lastly, several of the largest beetles in the world belong to the family.'

Mark well that where the beetles are gorgeously coloured, which is the phenomenon he is trying to explain away by sexual selection, their habits and organisation are interpreted to support this view. When, however, the sexes are alike in size, and of a sombre colour, no such interpretation is given to phenomena precisely similar.

CHAPTER XVII.

THE VARIATION AND NATURAL SELECTION ARGUMENT CONTINUED.

Lepidoptera.—Mode of pairing.—Disproved by actual observation.—The Emperor Moth.—Males taken in great numbers by exposing the Female.—Facts strongly against Sexual Selection.—Fine instance of adaptation to circumstances of existence, quoted from Mr. Wallace in the Kullima butterfly.—Beauty gained for protection, according to Darwin and Wallace.—Mr. St. George Mivart upon 'so-called' mimicry.—Goes to the root of Natural and Sexual Selection.—Vertebrates.—Fishes.—Amphibious Reptiles.—Birds.

The Lepidoptera (*Butterflies and Moths*).—Chapter XI. is almost entirely occupied with the difference in colour of the sexes and genera of this order. But Mr. Darwin makes some observations in the beginning deserving of comment.

'Several males may often be seen pressing and crowding round the same female. Their courtship appears to be a prolonged affair.' This I believe to be a great error in observation, and I speak with the authority of a twenty years' experience in rearing and collecting Lepidoptera.

Butterflies and moths may be both seen flying about or hovering over the females. They sometimes fight with each other. The Emperor butterflies do so as a rule. Mr. Darwin quotes a single instance. But it is an equally certain rule that the males may be flying about, guided by their sense of smell, in search of a female they know to be near, and while doing so tumble against each other and fight. Yet the female is always perfectly quiet, and takes no share whatever in selecting a male. The first who *finds* her is the successful wooer. I will relate a fact which I myself witnessed in the spring of the year 1871, and which in my mind settles the whole question of sexual selection. This and similar cases are not unknown to entomologists, although the general reader and admirer of Darwinism is in profound ignorance thereof. My nephew, Mr. Charles Bree, of Caius College, Cambridge, an active and zealous entomologist, asked me if I should like to see him catch some Emperor moths, then just out of their cocoons.

I accompanied him to a retired lane with hawthorn fences leading into a low-lying meadow, in which, about ten yards from the gate, he took out of his box two virgin females of the Emperor moth (*Saturnia pavonia minor*). He placed one of them on a thorn in the meadow, and the other on the fence of the lane. We waited patiently five minutes; no result. Five minutes more, and I began to grow tired. All at once, however, my nephew called out, 'Here he comes;' and looking down the meadow I saw a moth flying in a zigzag direction, first on one side then on the other, just as a pointer does his work after partridges. He came on nearer and nearer till he reached the tree. He made this his special bit of hunting-ground, and worked it carefully. At last he got to the branch on which the female was placed, and he hunted this branch in the same way as he had done the field and the bush. It was quite certain he did not see the female. At last he reached her, and the marriage rite was performed in a moment. The female all this time remained stationary, with an occasional gentle tremulous motion of her wings and exserted ovipositor. It is perfectly certain that had there been twenty males instead of one she would have been equally passive, without making the slightest *selective* effort.

In about an hour twenty males were captured. I ought to premise that the eager specimen-seeking entomologist did not allow the final act to occur until he had got the number he wanted. After marriage the female *ceases* to attract the males. So excited and fearless were the males that one came on to my hand, where I held the female. All this was clearly and without doubt done by the sense of smell, and entomologists know a number of gaily-coloured moths which may be captured this way—notably the celebrated and at one time rare insect, the Kentish Glory, which is first cousin to the Emperor—a single collector having by this method obtained 300 specimens.

Now the male Emperor moth differs considerably from the female. It is one of our richest coloured and most beautiful moths, and yet it is perfectly impossible that its gaudy colours were produced by sexual selection, the female being perfectly passive and indifferent who wins her. According to my experience this is the general rule among Lepidoptera and other insects, as well as among fishes, reptiles, birds, and mammals in a wild state. The caterpillar of the Emperor moth is one of the most beautiful of larvæ: green, with ribs, black bands, and numerous golden spots from which a few hairs grow.

Now here is a case in direct antagonism to Darwinism, and which cannot be explained away upon the line of that hypothesis.

After alluding to the fact that where the butterflies are of gaudy colours the males are always most so, Mr. Darwin deals with simulation, and quotes the following case from Mr. Wallace. The Kallima, or common Indian and Sumatran butterfly, 'disappears like magic when it settles on a bush, for it hides its head and antennæ between its closed wings, and then in form, colour, and veining cannot be distinguished from a withered leaf, together with the footstalk.' Now I direct particular attention to this fine illustration of adaptation. Is the insect conscious of its own appearance when thus simulating a twig? Mark, it 'hides its head and antennæ between its closed wings,' and this would *a priori* seem a good reason for the assumption that it did know all that it was about. Such an idea is, however, utterly untenable, for it would require the exercise of 'comparing' reason to play such a game of hide and seek. Could the butterfly ever have seen its own colour or appearance? Clearly not; the whole act is instinctive. But instinct does not act blindly. In many instances it is superior to reason, though on the whole much inferior, and instinct is a force evidently created and guided by reason external to the animal. This ever-present, ever-acting, and ever-active power either guided the insect to such nectar as would produce the requisite pigment, or it had implanted in its organisation the power of forming plumelets and wings, which would in certain positions look like a withered leaf with its footstalk. That the physical and mental co-ordination could have been gained because some moth in remote ages had during some part of its life varied in the direction of a withered leaf, that it had in consequence been saved while its congeners were eaten up, and that all this time it was conscious of the change going on in its organisation, that its mental powers in fact were correlated with its physical organisation *pari passu*, is a statement so utterly incredible that no scientific man need ever be afraid of confessing his ignorance in opposition to such a theory.

If Mr. Darwin will show us a power by which the object to be gained is arrived at without the slow gradual process of ages of variation, produced by mere chance in the first instance, and perpetuated in its 10,000 changes by chance also, there would be some congruity in his theory, and we should at least get something in exchange for the teleological argument. Let us pause a moment over the following passage: 'In some other remarkable cases *beauty has been gained* for the sake of protection, through the imitation of other beautiful species which inhabit the same district, and enjoy an immunity from attack by being in some way offensive to their enemies.'

This passage implies that an insect can 'imitate' the organisation of another insect, by means of a knowledge that such organisation is safer from enemies than that in which nature had clothed it. A more unsound, unphilosophical, unproved, reckless statement is not to be found in the whole range of the guesses of theoretical visionaries who have attempted to teach philosophy to their fellow-creatures since the world began. It is only just to say that the above theory did not originate with Mr. Darwin. It is the sole production of the fertile brain of Mr. Wallace.

Mr. St. George Mivart has treated the whole subject with great ability and most perfect fairness. He is one of our most distinguished comparative anatomists, and a genuine and ardent scientific worker. Let us hear what such a man says of the so-called 'mimicry,' in his recent work 'The Genesis of Species,' p. 33:—

'Now let us suppose that the ancestors of these various animals (the Mimics) were all destitute of the very special protections they at present possess, as on the Darwinian hypothesis we must do. Let it also be conceded that small deviations from the antecedent colouring or form would tend to make some of their ancestors escape destruction by causing them more or less frequently to be passed over or mistaken by their persecutors. Yet the deviation must, as the event has shown in each case, be in some definite direction, whether it be towards some other animal or plant, or towards some dead or inorganic matter. But as, according to Mr. Darwin's theory, there is a constant tendency to indefinite variation, and as the minute incipient variations will be in *all directions*, they must tend to neutralise each other, and at first to form such unstable modifications, that it is difficult if not impossible to see how such indefinite oscillations of infinitesimal beginnings can ever build up a sufficiently appreciable resemblance to a leaf, bamboo, or other object, for "natural selection" to seize upon and perpetuate. This difficulty is augmented when we consider—a point to be dwelt upon hereafter—how necessary it is that many individuals should be similarly modified simultaneously.'[1]

Nothing can more strongly point out the absurdity of 'mimicry,' so called by the Darwinians, and 'natural selection,' so called by Darwin, than the above searching criticism.

Mr. Darwin has already been obliged to modify

[1] See also *Genesis of Species*, p. 57; and *North British Review*, June 1867.

materially the opinions upon which he founded the hypothesis which is known by his name, and there are signs that he will be obliged to abandon the rest before many years have passed.

The intelligent reader will have remarked that the arguments adduced against mimicry go to the very root of 'natural selection,' as well as what is termed 'sexual selection.' I think it right, however, to follow Mr. Darwin into the vertebrate class of animals, which occupy the greater portion of his second volume on the 'Descent of Man.' I must be excused if I do this briefly.

Fishes.—Little is known to Mr. Darwin which will help him in his enquiry. He says they fight and 'court each other,' and he mentions several teleological appliances with which the males are furnished. But Mr. Darwin does not know the reason why the fighters have not been evolved into fishes larger than the females. He thinks it is probably 'to allow of the production of a vast number of ova.' With regard to colour, although the mode in which the ova of fishes are fertilised is so well known, Mr. Darwin still sticks to his theory that such colour is produced by being more attractive to the female; 'and that the males have thus been rendered more beautiful in the course of ages!' But when both sexes are equally brilliantly coloured, the theory breaks down. Therefore, says Mr. Darwin, the 'most probable view' in such cases is 'that the colours have been acquired by the males as a sexual ornament, and have been 'transferred in an equal, or nearly equal degree to the other sex.'

I ought to apprise those who may lose sight of the fact that this is actually approved scientific reasoning in the latter end of the nineteenth century! Fancy a stickleback in love with a gay spot in her male partner's scale!

Amphibians.—Mr. Darwin thinks it a matter of surprise that frogs and toads have not acquired more strongly marked sexual differences, for though cold-blooded their passions are strong. But then there is a frog, one of the Hylæ, which sings in harmony during the breeding season; and Mr. Darwin says this, as well as the 'croak' of the edible frog, may be attributed to sexual selection.

Reptiles.—*Tortoises* and *turtles* do not give any instances of sexual selection attributes. *Crocodiles* sometimes lash the water to 'win the female,' and during the season of their loves they emit a musky odour. *Snakes* are amorous, and have some reasoning power, and many of them are of extreme beauty and gorgeous colouring; but Mr. Darwin can make no use of them. They are dead against him. Lizards differ greatly in the sexes, chiefly in crests, horns, and snouts being prolonged in the male, particularly in *Chameleon bifurcus*, of whose horridly ugly deformed bi-nasal appendage Mr. Darwin gives a figure. But the authority of Dr. Günther is evoked to prove that they never fight, therefore the snouts cannot be 'sexual,' they must be 'masculine ornaments.' Many lizards are, however, brightly coloured, and Mr. Darwin concludes 'with tolerable safety' that those colours as well as the appendages have been gained by the males for the sake of ornament, and have been transmitted either to the male offspring alone or to both sexes.

Birds.—Mr. Darwin occupies 200 pages of letter-press upon the secondary sexual character of birds, which are 'more conspicuous and more diversified' than in any other class of animals.

'Birds,' says Mr. Darwin, 'appear to be the most æsthetic of all animals, excepting of course man, and have nearly the same taste for the beautiful as we have.' Mr. Darwin does not mean here to express the degree of taste, he merely wishes to draw attention to the similarity of tastes; for, he continues, 'this is shown by our enjoyment of singing birds, and by our women, both civilised and savage, decking their heads with borrowed plumes, and using gems which are hardly more brilliantly coloured than the naked skin and wattles of certain birds.'

I need not make any remark upon the 'law of battle' in birds. What is the object of the song in birds? Colonel Montagu thought it was to entice the female; and Mr. Jenner Weir, a bird-fancier, assures Mr. Darwin that this is the case with the nightingale. But, then, the male bird sings up to the time the young are hatched, but never after. This utterly refutes the above opinion. Mr. Darwin says this is done 'for their own amusement,' which of course suits his theory; but it is not true, as every competent observer knows. If it were so, why not 'amuse' itself when not feeding the young? For although this goes on both night and day, the young cannot be always eating, and there must be many a moment in which the male might 'take a song.' That it is not a courting manœuvre is equally proved by its continuance during incubation. Why not say that it is done to charm and please the patient partner who is hatching the future family? Is every beautiful idea as well as fact to be sacrificed to utilitarian speculation?

Many birds make noises with their wing-quills, like the turkey; or with their tail-feathers, like the 'drumming' of snipes, &c. Of course Mr. Darwin thinks all these sounds are pleasing to the females, and are produced by sexual selection. Antics and dances I may pass over.

Decoration.—This not only includes colour, but ruffs and elongated tails—like the peacock, humming-birds, and birds of paradise. These he considers are due to *sexual selection,* just as the tail of the fantail, hood of the jacobin, and the beak of the wattle carrier is due to *man's selection.* Some birds of either sex change colour when they moult, and some females of other species moult twice a year without changing colour; therefore, moulting has not been acquired to give the male a nuptial dress, but the double moult, having been 'originally acquired for some distinct purpose, has subsequently been taken advantage of in certain cases for gaining a nuptial plumage!'

According to Mr. Darwin, birds are fond of displaying their plumage; and, from the few exceptional cases in which such a feeling may be attributed—as in the peacock, &c.—he draws important aid to his 'sexual selection' hypothesis. If such a feeling exists at all—which I very much doubt, for I believe the females of birds care just as much for the gaudy colours of the male as they do for the gay ribbons in a lady's dress—it only proves that the breeding or nuptial plumage is given for a wiser purpose beyond ornamentation.

But what becomes of Mr. Darwin's moulting theory, as expressed above? *How, why, when,* did the bird take advantage of the double moult to put on a 'nuptial dress'? Mr. Darwin is bound to answer this question; and an answer is the more imperatively demanded when we find Mr. Darwin, in describing the Argus pheasant, with the beautiful ball-and-socket feather, alluded to by the Duke of Argyll, state that the most refined beauty, as exhibited by the male Argus in its nuptial dress, 'serves as a charm for the female, and for no other purpose.' 'Many will declare,' he continues, 'that it is utterly incredible that a female bird should be able to appreciate fine shading and exquisite pattern.' Among the utterly incredible I must beg leave to include myself.

Mr. Darwin lays a great stress upon the male birds displaying their beauty during the pairing season, by stretching out their wings; and he is especially delighted that there is a feather in each wing of the Argus pheasant of great beauty, which is only seen at such times. He also brings before his readers the testimony of Mr. Bartlett to prove that the 'eared' and 'cheer' pheasants, which are dull-coloured, in the Zoological Gardens, do not so display their wings. He does not forget, however, the domestic cock, whose wing movements are well known to everybody—not, however, to delude the lady he woos by exhibiting his charms, but as a simple summons to surrender.

And such is the habit of all birds, and such is the intention of the stretching of wings. That sexual selection has nothing to do with it there is abundance of evidence to show; for not only in the well-known habit of the cock, but in most birds whose habits are known, something of the kind is seen. Mr. Darwin cites the goldfinch, on the authority of the amateur bird-fancier Mr. Weir, as being particularly active in his wing movements; in fact, no British bird is more conspicuous. And yet both sexes of goldfinches have similar brilliant colours; and as he continues to stretch his wings now that all which sexual selection might give him has been attained, how are we to attribute to that supposed force the colour of the goldfinch's, or in fact any other bird's, plumage?

But in advocating sexual selection Mr. Darwin writes against himself. He observes that many male birds have acquired their ornaments at the expense of greatly impeded powers of flight or running, citing the African nightjar, the secondary wing feathers of the Argus pheasant, the plumes of the birds of paradise, the long tail feathers of the male widah-birds. But if this were true, it could not be in accordance with 'natural selection;' and Mr. Darwin cannot be permitted to use first one term and then another, as though they were synonymous. Again, Mr. Darwin says game-cocks suffer from their ornaments; as Mr. Tegetmeier informs him that a cock prepared to fight is dubbed, i.e., has his hackles trimmed and the comb and gills cut off. What puerility is this! Cocks in a state of nature would suffer no disadvantage in being un-dubbed. Each party would have his gills and hackles and comb untouched, but he would be no better nor worse than his antagonist, notwithstanding sexual had been allowed to supersede natural selection, and dub him a knight of the dunghill, in all his glory of hackles, comb, and gills!

Having filled a chapter with such reasoning as this, Mr. Darwin argues in the next as though all his points had been established upon the soundest basis. He recounts the number of instances in which birds, having lost their partners during the breeding season, are immediately supplied with others; and, with the assistance of Mr. Jenner Weir, he comes to the conclusion that during the pairing season there are numbers of birds 'who' (I quote his own words) 'do not succeed during the proper season in exciting each other's love, and consequently do not pair;' so that there is always a supply of unsuccessful wooers to fill up the places of those unions which are broken by the death of one or other of the pair—which he also cites as a proof that with many birds the courtship is a prolonged and tedious affair! Within a few lines, however, of this remarkable statement, he relates numerous instances of the rapidity with which the pairing takes place: in one instance, Mr. Jenner Weir informed him, a starling was supplied with three mates in one day.

But then we are told, in corroboration of these extraordinary and contradictory opinions, that birds, though decidedly of low reasoning power, are yet in some instances the contrary. They exhibit benevolent feelings, for they will feed the young of other birds; and Mr. Buxton relates the case of a parrot which took care of a frost-bitten cripple, cleaned her feathers, and drove enemies away. They also show sympathy for the pleasures of their fellows, as noticed in the interest taken by other cockatoos in a nest which a pair had built in Mr. Buxton's acacia tree. They have also curiosity and 'acute powers of observation;' and Mr. Jenner Weir is convinced that they pay particular attention to colours, because a black-headed bunting which he turned into his aviary was attacked by a bullfinch, the only other black-headed bird present! and a robin always attacked birds with any red in their plumage! And, lastly, Mr. Darwin thinks there is abundant proof that birds have taste, and are able to appreciate the beautiful—a belief which is a natural sequence of his views regarding coloration and sexual selection.

Then, the females, he says, show preference for particular males, which no one will deny who believes the old line about

The dove—which knows no second love.

An instance which he gives, however, of peculiar attachment is that of a female canary being turned by Mr. Weir into a cage with the males of the linnet, goldfinch, siskin, greenfinch, and chaffinch; and there never was a doubt about the selection, as 'the greenfinch carried the day' against the brilliantly-coloured goldfinch, which is opposed to sexual selection!

Artificial breeders of domestic fowls, like Mr. Tegetmeier, Mr. Hewett, and Mr. Brent, do not however believe that females prefer males according to their brilliant colours; neither did staining some pigeons with magenta by Mr. Tegetmeier make them get wives more quickly!

Mr. Darwin relates a case told by Sir R. Heron. A pied peacock, which was a great favourite with the hens, was shut up where he could be seen by them; and they kept close to him, and would not allow a black-winged male to go near them. In the autumn the oldest hen courted him and won him. The next year the pied cock was shut up in a stable where he could not be seen, and then the hens all courted the black-winged rival, a bird which we should call the handsomer one of the two. I confess I see nothing in this, and wonder why Mr. Darwin should have more than once alluded to it further on. Of course the pied cock was the favourite, and the hens stuck to him; but when they could not get another male, they put up with the black-shouldered rival. Mr. Darwin has however, it appears to me, expressed the truth, as regards birds as well as other animals, in the following passage:—

'In all ordinary cases the male is so eager that he will accept any female, and does not, as far as we can judge, prefer one to the other; but exceptions to this rule, as we shall see hereafter, apparently occur in some few groups.'

Mr. Darwin gives a complete and interesting description of the phases in development in the ball-and-socket ornament, or ocellus, on the wing feathers of the Argus pheasant, which gave rise to the unanswerable criticism of the Duke of Argyll in his 'Reign of Law.' Nothing can be more certain than that the changes described by Mr. Darwin all take place under the power of that reasoning and Divine architect whose hand is perceptible in every created thing. Mr. Darwin believes these beautiful ornaments have been produced by sexual selection, commencing ages ago; the colours becoming more and more pleasing to the tasteful eye of the female, and that, age by age, the inimitable pattern and shading have been attained in all their wonderful beauty. Mr. Darwin, while he thus writes, forgets that the process he describes and believes in would be, if true, ten thousand times more wonderful than the belief that such structures were specially and designedly created. I have no doubt that the Duke of Argyll will answer Mr. Darwin's remarks, should he consider an answer necessary.

Mr. Darwin believes that 'when the sexes differ, the successive variations have generally been from the first limited in their transmission to the same sex in which they first appeared.' He does not agree with Mr. Wallace, that 'in almost all cases the successive variations tended at first to be transmitted equally to both sexes.'

What Mr. Darwin truly calls a 'tedious discussion' ensues.

Now, Mr. Darwin's view that the accidental black bar on a male pigeon's wing is transmitted to future males only, necessitates a belief in a physiological fact of which we have not the slightest proof—that the seminal atoms of the male are potentially male and female, and that they continue so through all time. Mr. Darwin, however, refutes this notion himself in another part of his work, in which he expresses a belief that at one period of our respected ancestry we ourselves were hermaphrodite — *duo juncta in uno.* Such a condition must be an awful stoppage in the way of his theory. Pigeons and all other birds, beasts, fishes, or reptiles, according to Mr. Darwin's view of the descent of man, had a common ancestor in the amphioxus. This thing, the descendant of the molluscoidean ascidian, is the Darwinian parent of all vertebrates.[1] Pigeons therefore were at one time hermaphrodite, and could not *ab initio* have transmitted peculiarities to one sex alone. This is according to Mr. Darwin's view. I must beg my readers not to imagine for a moment that I lean towards the respected parentage that gentleman assigns to us. But I convict him on his own ground; in fact, 'hoist him on his own petard.'

I will not follow Mr. Darwin into the uninteresting discussion about spurs breaking the eggs when females sat, and which were therefore removed by 'disuse' or natural selection; and the presence of spurs in the female of the Java peacock, which do not break the eggs, and are therefore due to simple 'inheritance;' nor the discussion as to the different lengths of male and female birds' tails, although the account is enlivened by the detail of an Australian female kingfisher whose tail was too long, and therefore became crumpled; and the Menura, whose caudal appendage became askew from the same cause. All this is so puerile, and so unworthy of scientific discussion, that I shall be readily excused for simply omitting it.

In opposition to the Darwinian theory about sexual coloration, Mr. Wallace considers that the bright

[1] See Fig. 7.

colours of males were originally transmitted to the females, and eliminated by sexual selection. Mr. Darwin does not by any means admit this, and argues successfully against Mr. Wallace's belief, 'that when both sexes are coloured in a strikingly conspicuous manner, the nest is of such a nature as to conceal the setting bird; but when there is a marked contrast of colour between the sexes, the male being grey and the female dull-coloured, the nest is open, and exposes the setting bird to view.' Every schoolboy will be able to call forth, in disproof of this 'coincidence,' as Mr. Darwin calls it, being turned into a law, the following birds:—Goldfinch, robin, reed warbler, gold-crest, whitethroat, siskin, Lapland bunting, missel-thrush, song-thrush, rook, snipe, woodcock, hedge-sparrow, whinchat, stonechat, rocklark, sky-lark, all the pipits, quail, red grouse, ptarmigan, raven, Royston crow, the grebes, storks, plovers, spoonbills, eagles, woodpigeons, waxen chatterers, swans, geese, rails, bitterns, herons, &c. &c.

Mr. Darwin has a most summary way of disposing of the crests which 'egrets, herons, and many other birds' have, in both sexes, but only during the summer. 'They would,' says Mr. Darwin, 'be inconvenient, and certainly of no use during winter;' therefore, '*it is possible* that the *habit* of moulting twice a year *may* have been *gradually* acquired through natural selection, for the *sake* of casting off inconvenient ornaments during the winter'—a truly Darwinian paragraph, met by an equally characteristic antithesis. Birds of paradise, Argus pheasants, and peacocks do *not* cast off their plumes during the winter; therefore he concludes 'that the habit of moulting twice in the year was in most or in all cases first acquired for some distinct purpose, perhaps for gaining a warmer winter covering; and that variations in the plumage during the summer were accumulated through sexual selection, and transmitted to the offspring at the same season of the year; such variations being inherited either by both sexes or by males alone, according to the mode of inheritance which prevailed.'

Again I say that all this would be ten thousand times more wonderful than anything ever set forth by the most ardent believer in special creation.

CHAPTER XVIII.

THE VARIATION AND NATURAL SELECTION ARGUMENT, CONTINUED.

Sexual Selection, concluded.—Birds, continued.—Their colour.—How produced physiologically.—Known facts contrasted with Darwin's theory.—Mammals.—Monkeys and so-called Anthropoid Apes.—Man.—His superiority to Woman.—How gained.—Darwin's conclusions discussed and disproved.—Music.—How acquired.—Bestial origin according to Darwin.—Objections.—Conclusion of Sexual Selection.

THE sixteenth chapter—fourth and last upon Birds—is occupied with a detail of facts most diligently collected together, showing how the young of birds vary in their plumage as compared with the parents, or one of them. I do not dispute the facts, but the inference drawn from them I believe to be utterly untrue. Mr. Darwin classifies his cases under six heads, but in the last three he admits 'the facts are so complex and the conclusions so doubtful, that anyone who feels no especial interest in the subject had better pass them over.'

Before expressing any opinion upon the subject dealt with in this chapter, it will be advisable to say a few words upon the structure and colour of the feathers of birds.

I must not dwell long on this most interesting subject. Paley—the despised and superseded Paley—

remarks that 'every feather is a mechanical wonder; their disposition all inclined backward, the down about the stem, the overlapping of their tips, their different configuration in different parts, not to mention the variety of their colours, constitute a vestment for the body so beautiful, and so appropriate to the life which the animal has to lead, that I think we should have no conception of anything equally perfect, if we had never seen it, or can now imagine anything more so.'

A feather consists of a bulb, a shaft, and a vane or beard. Each vane is made up of barbs and barbules, and these are all planned and interwoven with each other, and the whole structure is shaped exactly according to the *functions* it has to perform as a flying organ, a steering organ, a covering, or an ornament. It is also formed and shaped and adapted according to the structure to which it is attached. If the feather be required for flying, it is formed in *reference* to the size and shape of the bones which assist in that function, and to the mechanical laws to which they are subservient. If for steering, then each feather is formed and adapted to the mode of flight; therefore the tail as a whole is formed in reference to the wings as a whole. Certain parts only of the body, called by Nitzsch 'feather tracts'—and each class, family and genus has its peculiar feather tract—have the skin uncovered. If feathers are ornamental, as in a crest, then each feather and all of them are formed and placed according to the habits of the bird. Every part of the plumage of a bird has its particular functions provided for by the pre-adaptation of the function-performing organ—a part and parcel of its structure and organisation.

Now these beautiful mechanisms are variously coloured, and the mode by which this colour is attained displays the same pre-adaptation, and is equally a part of the structure and organisation of the bird. To make a certain colour in a bird's plumage, either colour-pigment is deposited in appropriate cells, or the little barbules are striated so as to decompose the light, or both of these means may be found in the same feather. But to make this colour it may require 10,000 gradations, either in the pigment or in the length or depth of the microscopical striæ on the barbules. Dark pigment here, and lighter and lighter there—striæ which will decompose the light and enable the feathers to absorb the most brilliant rays, and so commingle them as to produce the most vivid, the most varied, the most beautiful colouring in the world. There must not be, there *cannot* be any mistake; the Mind which conceives and the Hand which guides are those of a Master. How does Mr. Darwin produce his colours? In some remote age pigment-cells or striæ came suddenly and fortuitously into existence, and a small speck of colour appeared in the plumage of a dull-coloured bird. This pleased the fancy and taste and intelligence and benevolence of the female, and she chose the mate with a spot and paired with him, and bore a family of birds with the same spot in the same place where it had so charmed the mother. In an indefinite time after this—when, perhaps, generations had passed away—the spot became fortuitously bigger or more vivid, by the accidental addition to the feather of more pigment-cells, or more striæ to the barbules. Again, the fortunate spot-bearer charms a female and she bears him a family. The larger spots now carry the day and become masters of the situation. The neglected small-spots get no wives and gradually go out of existence.

Again, in some remote age the last spotted bird varies, and at a different period of life, viz. as soon as he has gained a spot to vary. He is quite successful in charming the female and prospers, and we have now three different plumages which the brood of number three produces. First the young are like their progenitors before they varied; then, but at the same period of life in which their ancestors varied, does the greater or lesser spot appear. If the first varied when a year or two old, the young bird will have the larger spot in its nestling plumage and the smaller when he is a year or two old, or at one year old, if the variation first occurred at that time. So here is a retrogression of variation which is contrary to the laws of evolution, which, we are told, are from the simple to the complex. This, however, is what Mr. Darwin calls sexual selection. Unless the variation increases in a natural sequence of time, he can never get on at all, and such sequence can only occur in obedience to a law of organisation. But we are not asked to believe in a law of organisation, we are simply told that all the successive steps occur to please the female. The time cannot be far distant when the world of science must recover its equilibrium, and future ages will express wonder and doubt at the possibility of men who really understood the elements of science being led away into such delusions as beliefs in *natural* and *sexual* selection.

Mammals.—Mr. Darwin does not make much progress among mammals, inasmuch as there are no splendid colours to charm the female, except indeed the colours which are seen on the hinder and other parts of some monkeys, which he considers are due to sexual selection. The taste of early female monkeys does not appear to have been exercised upon our immediate Darwinian progenitors, which I think is especially unkind, for an ultramarine blue nose and yellow whiskers would have been something fresh for the civilised and humanised dandy. However, we do not see any of such colours among the anthropoids. *Pithecus satyrus*, the Asiatic orang-outang, has nose and fingers of lead-colour, while his hair is of a bright brown, showing how the penultimate links in the monkey part of man's genealogy were becoming more sober in their tastes. *Hylobates Hoolock*, the gibbon who first commenced hook noses, must have been a dangerous candidate among the ladies of his time, for he has a white fringe round his forehead and face, and the hair of his head is continuous, so as to form a whisker; while his conqueror, *Hylobates syndactyla*—the siamang—a Sumatrian gibbon, and jet black all over, is notorious for having his hair on the frontal bone smooth and straight; and I suppose this fact was pleasing to the female, for the monkey is very common in these days in its peculiar locality. It is one of the howling tribe, and has evidently, somehow or other, managed to pass this quality into our 'ape-like progenitor,' and from him downwards to the civilised partisans of borough elections, or the anti-knowledge league of 1871. On the border-ground of anthropoids we meet with a monkey which must have been a sore puzzle to sexual selection—the proboscis monkey, *Nasalis larvatus*—which has an enormously long nose, a *black* face, *brown* head, dirty yellow cheeks and back, becoming lighter on the rump, with the posterior sides of the abdomen dark brown with white spots. Still more perplexing must have been the Cochin China monkey, *Lasiopyga nemea*, and various must have been the tastes of the sexual selecting females. This beast has a reddish face, black forehead; grey nape, upper arms, and sides of abdomen; yellowish white whiskers, forearms, rump, and tail; brown black thighs and feet and hands, and bright reddish-brown legs. Let any rational person apply his reflective powers in accounting for these various colours according to the doctrine of sexual selection—they are just the points Mr. Darwin leaves out—and then reconcile his contemplation with the fact that this monkey, with all his means of exciting feminine selection, is one of the rarest in existence.

As we recede further from the anthropoid monkeys, we get more brilliant colours. *Semnopithecus melalophas,* a rare monkey—the simpai of the Javanese—which is only a foot long, with a tail twice or thrice as long, has an ultramarine face and a crest at the back of the head of the same colour, while the rest of the body is rich brown, with white flanks and nude thighs; altogether a very handsome fellow and intelligent withal. In the varied monkey, *Cercopithecus mona,* there are six or seven bright colours, which must have given sexual selection a vast deal of trouble.

But nowhere does so-called sexual selection triumph in its accomplishment more than in the mandril, or rib-nose baboon *Papio Mormon* (Geoff.), specimens of which are always to be seen at the Zoological Gardens and in almost every menagerie. This hideous brute, the fiercest and most malignant in disposition of all monkeys, is a native of the Guinea coast, and in its adult condition is ornamented with brilliant colour. It is about two feet long, has a lengthened muzzle, with nostrils occupying the centre of the upper lip, projecting in a snout-like manner. Between the nose and the eyes the naked skin is divided into ribs and coloured with ultramarine blue; its forehead, parts behind the ear, back shoulder and legs, black brown; cheeks, spot behind ears, back of head and nape, front of chest and 'posterior' parts, dirty yellowish white; nose, ears, hands anteriorly, and naked parts round stumpy tail, purplish red. In the female, who is less in size, the colouring is the same but less vivid. The young are of a uniform tawny green, paler beneath, with yellow cheeks; and, according to Mr. Darwin's theory of sexual selection, this must have been the colour of the progenitor of the mandril. Now, we may fairly ask the question, did the nose and stern vary at different times? As the passions of these brutes are essentially strong and bestial, we have a right to assume that a purplish spot behind first attracted the female, and an ultramarine spot ages after on the nose—both variations occurring when the creature was of adult age; then a white spot behind first one ear and then another, then a toe became purple, then another; then the yellowish white stern, and so on.

If sexual selection had anything to do with these changes—and Mr. Darwin says it entirely produced them—the variations must either have occurred simultaneously, or one spot became added to because the females chose those with such spots. But does variation cause variation? Does it follow because the female preferred a baboon with a purple spot behind, or a blue spot on the ribbed nose, that her predilection for such spots would cause them to grow larger and larger? That new cells should be formed in the organic structure, and new vessels sent out to carry blue or purple pigment all round the original variation, and that such a process should be repeated over and over again through myriads of years, until the savage mandril (who from all accounts does not wait to be selected) should have been perfected in his present state? Such, however, is the doctrine of sexual selection.

Man.—From the monkeys of course the next step is to man, and I am glad to say the last I shall have to notice, for it is a dull and dreary road to follow a man through the phases of an impossible belief.

I will not follow Mr. Darwin through his details of the differences between man and monkeys, nor through the chief part of the details of the difference between man and woman in mental and physical powers. He gives this of course against the woman, and at page 328 Mr. Darwin tells *how* this superiority has been gained. Let us have his own words:—

'But these latter (imagination and reason) as well as the former (genius) will have been developed in man, partly through sexual selection, that is, through the contest of rival males; and partly through natural selection, that is, from success in the general struggle for life; and as in both cases the struggle will have been during maturity, the characters thus gained will have been transmitted more fully to the male than to the female offspring. *Thus man has ultimately become superior to woman.*'

Now let us pay particular attention to what follows: '*It is indeed fortunate that the law of the equal transmission of characters to both sexes has commonly prevailed throughout the whole class of mammals, otherwise it is probable that man would have become as superior in mental endowment to woman as the peacock is in ornamental plumage to the peahen.*'

There is something bewildering in the above passage. First it assumes a doubtful point, viz. whether man is really more highly endowed mentally than woman. Mr. Darwin says the latter would become so, were her imagination and reason exercised to the highest point when 'nearly adult, and so be able to transmit such qualities chiefly to her adult daughters.'

This statement again assumes that at adult age the two brains, male and female, are physically different to the degree of rendering it impossible for the female brain to attain as high a pitch of reasoning as the male. Such an assumption as this can easily be proved to be as false as the statement that it would be necessary so to educate women that they might transmit their educated qualities to their female children. Women are destined to different walks in life from men. They are not educated as a rule to master science or dead languages—neither are they exercised in mathematics. But to say they could not were they required master these subjects is falsified by the most ordinary knowledge of women and the positions they do and might hold in the intellectual world.

Few men have written more eloquently and well upon the deep subject of astronomy than Mrs. Somerville. Nay, I will go further and say there are few men who could be *educated* to surpass her. The science of medicine has been hitherto closed to women, but we have recently seen them surpass many men in their collegiate examination. One of the best works in the French language upon one of the most difficult subjects in medicine is written by a Frenchwoman. In art have we not the inimitable Bonheur; and what men ever wrote more beautiful and real poetry than Mrs. Hemans, or better prose than Madame de Stael or De Genlis? Have we not seen women lately elected for their high mental qualities to the highest Educational Board in the United Kingdom?

But against knowledge like this, facts like these, truths like these, we are met by a miserable theory of sexual selection, and the testimony of Vogt, that female skulls are smaller than those of men. Of course they are, and so is every bone in their body and every part of their structure. Is not their destiny different to that of man? Why then should they not be organised in proportion? Had Vogt not been, like Darwin, a prejudiced speculator, he would never have committed himself to the statement quoted by Mr. Darwin as experience of his opinion that woman's mind is inferior to man's. The following is the quotation: 'It is a remarkable circumstance that the difference between the sexes as regards the cranial cavity increases with the development of the race, so that the male European excels much more the female than the negro the negress.' Of course he does. But simply because the entire body of the European female differs more in size from the male than does that of the negress from the negro, which entirely explains the difference. In all normal skeletons the different bones are proportionate in size, and although you occasionally find a small head upon a large body and *vice versâ*, these are exceptions to the rule, exactly suited as such to support an hypothesis which is entirely built up upon suppositions and exceptional facts.

Music is considered by Mr. Darwin to have been acquired by our animal ancestors by sexual selection. Considering the matter as settled, he writes:—

'Women are generally thought to possess sweeter voices than men, and as far as this serves as any guide we may infer that they first acquired musical powers in order to attract the other sex.

'But if so this must have occurred long ago, before the progenitors of men had become sufficiently human to treat and value their women merely as useful slaves. The impassioned orator, bard, or musician, when with his varied tones and cadences he excites the strongest emotions in his hearers, little suspects that he uses the same means by which at an extremely remote period his half-human ancestors aroused each other's ardent passions during their mutual courtship and rivalry.'

Mr. Darwin actually revels in the pleasure of referring our best and noblest attributes to a bestial origin. When he talked about idiots walking on all fours, showing their tendency to retrograde in organisation, and of men displaying their canine teeth when they sneered at his theory like the baboon—he merely excited a feeling of pity that a man capable of better things should utter such sentiments; but the sentence I have quoted surpasses anything of the kind ever written by him.

I here close my criticism of Mr. Darwin's doctrine of sexual selection, and I submit with perfect confidence that I have proved his theory to be devoid of any scientific basis, that it is founded upon mere assumption, and that the phenomena adduced in proof have been totally misinterpreted. The time required for his sexual selection would upon his own theory, were there even a soul of truth in it, have been sufficient to have evolved his species into something else. It is inconsistent with that theory to assume that when any of his subjects of sexual selection, far down in the vista of past time, began to yield up their organic structure to the blandishments of feminine coquetry, they were then even of the same species as they are now. *Natura non facit saltum.* They must long since have become evolved in another direction, for the changes in colour would 'correlate' with other organic changes, and a Darwinian species totally different, even as a reptile is from a bird, must have been the outcome of such organisms' variation.

But change of colour, correlation, secondary sexual character, and evolution of mind are Darwinian attributes especially reserved for use only along the line which their inventor chooses to take them.

CHAPTER XIX.

THE VARIATION AND NATURAL SELECTION ARGUMENT, CONTINUED.

Mr. Darwin's Supporters.

Mr. Alfred B. Wallace.—Creation by Law.—The Duke of Argyll.—Reign of Law.—The Universe, according to Wallace, self-regulating.—Madagascar Long-nosed Moths.—The *Angræcum sesquipedale* and its nectary.—Mr. Wallace's mode of making Moths' noses.—River beds.—Humming Birds.—Beauty of form and colour.—Separately and for themselves provided for in Nature.—Types or patterns in nature.—The Vertebrate type as adapted to infinite variety of life.—Difficulties of Mr. Wallace in reconciling beauty of form or colour upon his principles with Mr. Darwin's maxim, *Natura non facit saltum.*—Mr. Wallace's inapt reference to Bull-dogs and Greyhounds.

In leaving the latest works of Mr. Darwin, we are naturally led to ask what testimony has been brought forward in favour of his theory by one who was termed by Dr. Hooker in the Norwich address, 'Mr. Darwin's true knight.'

Mr. Wallace has published several papers in various scientific journals. I propose to limit my notice to two: 'On Creation by Law'[1] and 'The Philosophy of Birds' Nests.'[2] The observations upon *creation by law* are chiefly answers to the trenchant arguments

[1] *Journal of Science*, Oct. 1866.
[2] *Intellectual Observer*, vol. xi. p. 413.

of the Duke of Argyll against Mr. Darwin's hypothesis in his well-known work, 'The Reign of Law.'

Mr. Wallace shelters himself in the beginning by the remarkable statement that the 'noble author represents the feelings and expresses the ideas of that large class who take a keen interest in the progress of science in general, and especially that of natural history, but have never themselves studied nature in detail, or acquired that personal knowledge of the structure of allied forms—the wonderful gradations from species to species and from group to group, and the infinite variety of the phenomena of "variation" in organic beings—which are absolutely necessary for a full appreciation of the facts and reasonings contained in Mr. Darwin's book.'

It is impossible to condemn too strongly this style of reasoning. Does Mr. Wallace mean that those who have studied the scales on butterflies' wings or the feathers in birds' changing and ever variable plumage, are the only people to whom the truths of Darwinism are appreciable? Are not all the works of Mr. Darwin open to the Duke of Argyll, and does he not show by his argument that he thoroughly understands them? Is the great knowledge in comparative anatomy in all its phases of such men as Agassiz or Flourens to be compared for a single moment with that of amateurs in Darwinism? And what is the chief line of objection taken by the Duke of Argyll? Exactly that which we shall see presently is the argument taken by Agassiz, viz. the ever-present proof of mind in the various and varied organisms of the world. But Mr. Wallace is a warm disciple of Mr. Herbert Spencer, and we have shown how abhorrent to his train of thought is the presence of a Creator or Providence in nature.

Mr. Wallace is not long before he makes us acquainted with this fact, which, in strict fairness of argument, ought to place him out of the pale of discussion. The Duke, he says, believes in the personal application of general laws in producing 'variety, harmony, design, and beauty.' 'I believe, on the contrary, that the universe is so constituted as to be *self-regulating*; that as long as it contains life the forms under which that life is manifested have an *inherent* power of adjustment to each other and to surrounding nature; and that this adjustment necessarily leads to the greatest possible amount of variety and beauty and enjoyment, because it does depend upon general laws and not on a continual supervision and re-arrangement of details.'[1]

According to this statement, Mr. Wallace would account for the plan or design of nature as having been produced by secondary laws; a statement I hold to be utterly without proof and untenable.

Further on Mr. Wallace alludes to the beautiful *contrivances* and designs exhibited, according to Mr. Darwin's well-known researches, in the fertilisation of

[1] *Op. cit.* p. 473.

orchids, and he asks, 'Is it not then an extraordinary idea to imagine the Creator of the universe *contriving* the various complicated parts of these flowers as a mechanic might contrive an ingenious toy or a difficult puzzle?' Not in the least extraordinary, I say, to those who believe in special creation—very difficult certainly to those who do not. This is simply the question. Mr. Wallace says that these contrivances are the effect of general laws implanted in the original speck of organic matter which is all these transmutationists allow the Creator to have formed. But he makes the sad blunder of letting the case go against him by his own admissions, because if these contrivances are the effect of creative *laws*, they are equally the 'special' work of the Creator, and therefore there would be nothing 'extraordinary' in the matter as suggested by Mr. Wallace.

Mr. Wallace next takes us all the way to Madagascar. In the beginning of his paper he favours us with a plate—in which a few ghastly-looking moths of the humming sphinx family are represented as thrusting their enormous proboscides into the nectaries of an orchis, *Angræcum sesquipedale.*

A very taking picture it appears, with the morning sun shining through the mysterious depths of the forest. It would be still prettier were it *true.* Unfortunately however, both for Mr. Wallace's theory and for his discretion, the picture is altogether a sham. The orchis is there sure enough, with its long nectary conspicuously displayed, but the moth with its long 'nose' (the misnomer is that of the learned in the variation of organic beings, not mine) is altogether a myth. No such moth is known to be in existence, but Mr. Wallace with exquisite naïveté suggests that naturalists who go to Madagascar should search for it! Search for what? the reader will naturally exclaim. Why, the mythical thing created in Mr. Wallace's picture, and placed there to prove the truth of Darwinism! After this it will perhaps amuse those who are uninitiated in the mysteries of Darwinian biology to know how the long nectary was manufactured, and how the moth—that is to be—obtained its long proboscis. Mr. Wallace only starts when the nectary of the Angræcum was half its present length, which is, I think, especially unkind, for one actually feels a longing to know how he accounts for a nectary at all. Well, then, when this nectary was about six inches long, it was chiefly fertilised by a species of moth which appeared (how kind of it) at the time of the plant's flowering and whose proboscis was of the same length. Then, among these flowers some would have nectaries longer than six inches, others shorter—so says Mr. Wallace and so requires his theory; and the short ones, having no moth's nose to carry down the pollen, would not get fertilised, because, the nectar only occupying about an inch of the nectary, the happy moth could get it all without going to the bottom! Pardon me, Mr. Wallace, such a thing would be utterly impossible. How such an argument could be advanced by anyone aiming at scientific precision is marvellous. But the long nectaried flowers would be well fertilised and the longest would, on the average, be the best fertilised of all! And thus Mr. Wallace accounts for the 'preservation of the fittest' and the ultimate extension of the nectary to a foot in length! Turn now a moment to the mythical moth with a proboscis twelve inches or more in length. How came he (supposing he is ever found) to get such a 'nose'? Mr. Wallace describes it to have been quite an easy matter, and it was done in this wise. By the process above detailed, the nectaries would get too long for the moths, never be fertilised, and die out.

Now remember that it is assumed this fertilisation takes place by the chance conveyance of pollen grain upon the moth's proboscis; which, of course, in any case is washed off the moment the proboscis reaches the nectary. And yet we have here Mr. Darwin's right-hand man—the claimant to equal honours as to the introduction of this hypothesis of transmutation—we have here this 'true knight' asking sensible people to believe that if one nectary were a little shorter than another, then the longer proboscis of the moth would not have occasion to go down to the bottom of the nectary, and *therefore* the orchis would not be fertilised!

In the course of a somewhat long life's reading and observation, I must confess that I never knew a great biological question supported upon such utterly groundless and absurd data. But to proceed with the moth's history.

Well, by-and-by, the nectaries increasing in size and the proboscides remaining stationary, the plant would cease to exist in nature were there no other moths living with longer proboscides.

Now just in the nick of time these mythical lepidoptera step in and drive away the degraded short-noses, who would thus be destroyed in the 'struggle for existence,' and the 'long noses' would remain masters of the field. And so the game would be carried on, and the 'long nectaries' and 'long noses' would be perpetuated, while the short ones would go out, until we get a nectary a foot long and a moth with a proboscis of at least eleven inches; which is, however, as I stated before, at present a scientific desideratum, inasmuch as Mr. Wallace is obliged to admit that the largest proboscis he has ever known is that of a South American species in the British Museum, which measures *nine inches and a quarter*. This is what Mr. Wallace calls beautiful 'self-acting adjustment,' and he is quite shocked at the idea of the Duke of Argyll that this could be done by a direct act of the Creator's power, and actually says that the Duke has no proof either to give or suggest that his view is the right one! So delighted is Mr. Wallace with his explanation of how nectaries and proboscides are evolved, that he rushes into the altogether inappropriate and inapplicable illustration which *inorganic* *nature* gives us in the formation of river beds. He says that any one ignorant of geology who examines a river system would remark that it had evidently been 'created by mind,' and would listen with 'incredulity to the geologist who assured him that the adaptation and adjustment he so much admired was an inevitable result of the action of general laws;' and further on he suggests that the Duke of Argyll would agree with the geologist. What the opinion of the Duke of Argyll may be I have no means at present of knowing, as I am not aware that he has thought it worth while to answer Mr. Wallace's remarks; but I will take the liberty of saying that a much greater man than either Mr. Wallace or Mr. Darwin—I mean Newton—did not think it beneath the dignity of the science he so much enlarged, or derogatory to him as a philosopher, to declare that the force, the laws of which he himself discovered—that of gravitation—was inexplicable on any other theory than that which ascribed it to the hand of God. And yet this gravitation is the principal force concerned in the formation of these river systems! But Mr. Wallace does not believe in the necessity of a special Providence, or even its existence. 'I for one,' he says, 'cannot believe that the world would come to chaos if left to law alone.' What he means by law we gather from the context, and by his agreement with Mr. Spencer in the operation of physical forces, which he correlates with those of life; in other words the doctrine of evolution, as enunciated by Mr. Herbert Spencer.

Now it would be an insult to the good sense and feeling of my readers were I to enter here into a defence of a special Providence, and of a continuing, ever-present, ever-active mind, which presides over and directs the formation, the adaptation, and the disposition in space of all organised as well as unorganised nature. Mr. Wallace says this cannot be proved. In fact, his theory must altogether fall to pieces if it be true. With a mind thus strongly biassed in one direction, he cannot admit such proofs as are given by Agassiz, or which are demonstrable by the formation of a wheat-straw, or the opening of the thoracic duct into the veins of the neck of his own body. He says, 'The theory of continual interference is a limitation of the Creator's power.'

Talking of adaptation and varieties of colour he remarks that the Duke does not attempt 'to explain this except by reference to the fact that "purpose" and "contrivance" are everywhere visible, and by the illogical deduction that they could only have arisen from the direct action of some mind, because the direct action of our minds produces similar contrivances.' I feel quite sure that if such remarks as these required an answer at all, the Duke of Argyll is able to answer them most triumphantly. It is some consolation to reflect that in a scientific discussion there are but few men who would make them at all.

Passing from 'mind' and 'contrivance' as applied to structure, Mr. Wallace finds equal fault with the Duke of Argyll in his remarks about 'beauty.' The Duke, with 999 in every 1,000 reflecting and thoughtful men, states, with regard to 'humming birds,' that there is no connection which can be either traced or conceived between their splendour and any function essential to life—this splendour is confined to the male sex almost exclusively.

But, says Mr. Wallace, Mr. Darwin *has* met the statement and has shown 'by observation and reasoning how beauty of colour and form may have a direct influence on the most important of all the functions of life, that of reproduction.'

The Duke of Argyll responds that the colour of the various humming birds is quite irrespective or unconnected with their difference in structure, and then continues to remark: 'Plumes of blue are of no more value in the "struggle for existence" than plumes of green. Spangles of the emerald are no better in the battle of life than the spangles of the ruby. A crest of flame does not enable the humming bird to reach the curious recesses of an orchid better than a crest of sapphire. But all these are beautiful, and their beauty is various, and therefore all these are given.' . . . 'It would be to doubt the evidence of our senses and of our reason, or else to assume hypotheses of which there is no proof whatever, if we were to doubt that mere ornament, or mere variety are as much an end and aim in the workshop of nature as they are known to be in the workshop of the goldsmith and the jeweller. Why should they not? The love and the desire of them is universal in the mind of man.'[1]

After describing the various beauties of those exquisite creatures (the humming birds), the Duke proceeds:—

'There is not the smallest ground for believing—on the contrary, there is every reason to disbelieve—that all these changes or any of them *have any other use than the use of beauty*,' and he quotes as a conclusive proof of this what I have before mentioned, viz., that 'all this splendid ornament is almost always confined to one sex.'

The Duke then dwells upon the beautiful adaptation to special purposes so conspicuous in the group. 'They feed mainly on insects which frequent the flowers of the New World, and some of these have nectar chambers of most curious plan. To get access to them requires a peculiar apparatus, and this apparatus the humming birds are provided with, both in the forms of bill and in the powers of wing. *So special is the adaptation that some kinds of humming birds seem to be made to match a few plants which are perhaps confined to a single mountain.*'[2] As an instance in which ornament takes the place of pictorial representation, the Duke instances the secondary feathers of the Argus pheasant, which are decorated with a series of conspicuous spots

[1] *Reign of Law*, 230. [2] *Op. cit.* 231.

or 'eyes,' so coloured as to imitate the effects of balls. '*The shadows and the high lights are placed exactly where an artist would place them so as to represent a sphere.*' The 'eyes' of the peacock's train are wonderful examples of ornament, but they do not represent anything except their own harmonies of colour. The 'eyes' of the Argus pheasant are like the 'ball-and-socket' ornament which is common in the decorations of human art.

'It is no answer to this argument in respect to beauty that we are constantly discovering the use of beautiful structures in which the beauty only and not the usefulness had been hitherto perceived. The harmonies on which all beauty probably depend are so mutually connected in nature, that 'use' and ornament may often both arise out of the same conditions.'[1]

I have already dealt at length with sexual selection, but, as bearing upon the Duke's argument, I must reiterate the following facts. In the first place, we have no proof whatever that the insect or bird sees colours in the sense that we do; and in the second place we have positive and distinct proof that the bird's plumage is more or less influenced by the condition of the genital organs. Thus birds assume, as a rule, a more marked and distinctive plumage in the breeding season, and the well-known dissections of Yarrell have fixed the phenomenon of the female's

[1] *Reign of Law* (*Good Words*, 1865), p. 230.

assumption of male attire in the pheasant to disease of the ovaries. Here, then, we obtain a clue to the elucidation of at least one cause connected with the organisation of the bird which has more or less influence over the tints of the plumage. And as a rule the influence is uniform and regular.

Just as the insect puts on the colour of the lichen, so does the ptarmigan assume that of the rocks or snow among which it dwells, and these changes begin when the bird breeds in the spring, and end when it goes into snowy quarters for the winter. As the Duke of Argyll observes:—'The evidence is indeed abundant that ornament and variety are provided for in nature for themselves and by themselves, separate from all other use whatever. Any theory on the origin of species which is too narrow to hold this fact must be taken back for enlargement and repair. At the very best it must be incomplete. But here the question arises, Is there any ground for anything at all on the "origin" of species, such for example as the various kinds of humming bird? Beauty, variety, fitness for a peculiar mode of life—in these we see a purpose; but is there any indication of a method according to which the purpose has been pursued? . . There is indeed immense variety, but it is variety within the bounds of law.' And then, after detailing the peculiarity of structure in the humming birds—viz. the peculiar form and constant number of ten either rudimentary or developed feathers of the tail, which, the Duke observes truly, more than in other species, suggests the operation of some physical law—he remarks :—

'Now this is only one example of a great class of facts of continual recurrence in nature. The forces which are combined for the moulding of organic forms have been so *combined as to mould them after certain types or patterns.* It constantly happens that particular parts of any given type which are indispensable to one animal are of no use whatever to another. Where they are of no use they are enlarged, developed, expanded. For example, the forearm of all the mammalia, and even of all the lizards, terminates in five jointed bones or fingers. But in many animals the whole five are not needed, but only some one, two or three. In such cases the remainder are dwarfed, but rudimentally the whole number are always to be traced. Even in the horse, where only one of the five is directly used, and where this one is enlarged and developed into a hoof, parts corresponding to the remaining four fingers can be detected in the anatomy of the limb. In many cases the science of fossil remains enables us to trace the intermediate forms through which existing animals can be connected with animals long since extinct. It must be remembered that the fact of this connection is quite a separate thing from any theory, such as Mr. Darwin's, as to its physical cause.'

'Professor Owen pointed out, in public lectures delivered some years before the publication of Mr. Darwin's book, the existence of fossil animals which showed an increasing approximation to the forms of the horse and of the ox; and he showed that this approximation was related in time, as it seemed to be in purpose, with the coming need of them for the service of man.'

'All these facts should convince us that we must enlarge our ideas as to what is meant by "use" in the economy of nature. In the first place it must be so interpreted as to include ornament; and in the second place it must include also not merely actual use, ***but potential use, or the capacity of being turned to use in new creations.*** In this point of view rudimentary or aborted organs need no longer puzzle us, for in respect to purpose they may be read either in the light of history or in the light of prophecy. They indicate either what has already been or what may yet come to be. Why new creations should not have been made wholly new; why they should have been always moulded on some pre-existing form; why one fundamental groundwork should have been adhered to for all vertebrated animals, we cannot understand. But as a matter of fact it is so. For it appears that creative purpose has been effected through the instrumentality of forces so combined as to arrange the particles of organic matter in definite forms; which forms include many separate parts capable of arrestment or development, according as special organs are required for the discharge of special functions. Each new creation seems to have been a new application of these old materials. Each new house of life has been built on these new foundations. Among the many wonders of nature, there is nothing more wonderful than this—the adaptability of the one Vertebrate type to the infinite variety of life to which it serves as an organ and a home. . . . Here again the laws of nature are seen to be nothing but combinations of force *with a view to purpose*; combinations which indicate complete knowledge, not only of what is, but of what is to be, and which foresees the end from the beginning.'[1]

I have quoted these admirable opinions and arguments at length to show, in the first place, how exactly they agree with the view held by Agassiz; and secondly, because they perfectly coincide with those of the large body of scientific men who have not hitherto been tainted with the Darwinian heresy.

But they do not satisfy Mr. Wallace. This gentleman remarks that the Duke's argument is founded on the supposed analogy of the Creator's mind to ours, as regards the love of beauty for its own sake; and then he asks why the Creator has made things ugly like the 'elephant, rhinoceros, and camel.' Now there is a double error in these remarks of Mr. Wallace. Neither the Duke of Argyll nor any other scientific writer that I am acquainted with has ever ventured to say that the Creator's mind is the same as ours. Most men would regard such a statement as simply

[1] *Reign of Law* (*Good Words*, 1865, p. 232).

blasphemous. What Agassiz and the Duke have argued is, that there is evidence in every step of creation, and in every phase of organic development, of foreknowledge, design, and reason. And they venture to say that these Divine faculties are not seen in chance variation, pampered monstrosities, 'struggle for existence,' 'survival of the fittest,' and development by physical forces, as enunciated in Mr. Spencer's dogma of evolution.

Secondly, it is a great and unpardonable error to say that there is anything in nature, when viewed with a scientific eye, and with a mind imbued with a love and reverence for the Great Artificer, which can be termed ugly in the strict meaning of the word. Nor is there any excuse for applying the epithet to one of the most wonderful and beautiful structures in creation —that of the elephant.

But with regard to beauty, there is one fact which Mr. Wallace has entirely overlooked in the papers I am now criticising, and which has been quoted as worthy of praise by Dr. Hooker, when President of the British Association. According to Darwin's theory, *natura non facit saltum.* He states over and over again, that all the results we have seen have been produced in nature by variations so slight as to be practically unnoticeable. How does Mr. Wallace reconcile this fact with his theory that the beauty of the male plumage has been produced by variation, which gave him greater advantage over his fellows in the matter of pairing? If we cannot see gradual variation, it ceases to be an element in the 'survival of the fittest' among male humming birds.

Were nature to take a sudden jump, and evolve a gorgeous male bird or insect with attractive colourings, we could understand how the female, should she see as we do, might like a vain woman be attracted by a gilded waistcoat or a red coat. But it must be remembered that Mr. Wallace and those who agree with him have to evolve their full-fledged gallant by inconceivably minute changes occurring through vast eons of time. And this must, I opine, be utterly fatal to their theory. There is no use in telling us that a small speck of blue here, or a shade of sapphire there, or a microscopical spot of colour anywhere, will prove more attractive to the female, and give the evolving humming-bird an advantage in the struggle for existence.[1]

Mr. Wallace has also attempted to strengthen his case by assuming that the believer in special creation assigns to the Creator the mere variations which occur in species, or in the monstrosities produced in this direction by human agency; and he goes out of his way to urge forward in proof that, if men wanted a bull-dog to torture another animal, a greyhound to catch a hare, or a bloodhound to hunt down their oppressed fellow-creatures, that the variations from the original stock

[1] This was written before the appearance of Mr. Darwin's last work, but I have seen no reason to alter the text.

were the direct agencies of the Creator as much as the creation of species. Mr. Wallace has no grounds for making the assertion as a matter of fact that all our domestic dogs have arisen from the 'same original stock.' Even Mr. Darwin admits a plurality of progenitors for this animal,[1] and that the Creator should be held responsible for the brutal employment of the bull-baiter or the slave-owner is most unwarrantable.

[1] *Animals and Plants under Domestication*, vol. i. p. 33.

CHAPTER XX.

THE VARIATION AND NATURAL SELECTION ARGUMENT, CONTINUED.

Mr. Darwin's Supporters.

Mr. Alfred B. Wallace, continued.—Philosophy of Birds' nests.—Not built by instinct, according to Wallace.—M. Flourens' remark upon such a theory.—The Arab's tent.—The Patagonian hut.—Built by 'imitation.'—The Egyptian mud houses.—The Pyramids.—Birds' nests.—Material of.—Swallows build their nests of mud, because they fly over ponds in search of flies.—Absurdity of such opinions.—Young Birds learn to build their nests from their parents.—Mr. Wallace's separation from Darwin in regard to the Creation of Man. —The subject considered.—Its teleological significance.

TURNING from Mr. Wallace's remarks on 'Creation by Law,' let us examine his article on the 'Philosophy of Birds' Nests.' Mr. Wallace adopts Mr. Darwin's view that there is no such thing as instinct at all, in the sense in which we understand the word. He considers it the 'result of small contingent consequences, as produced by natural selection.'

Well may M. Flourens remark upon this singular theory: 'On ne peut prendre cela au sérieux, l'élection naturelle élisant un instinct.

La poésie a ses licences; mais
Celle-ci passe un peu les bornes que j'y mets.'

Mr. Wallace states his theory thus :—

I believe, in short, that birds do *not* build their nests by instinct; that man does *not* construct his dwellings by reason; that birds do change and improve when affected by the same causes that make men do so; and that mankind neither alter nor improve when they exist under conditions similar to those which are almost universal among birds.'[1]

Mr. Wallace supports this remarkable statement by asserting that the Arab builds the same tent he did 2,000 or 3,000 years ago; the mud villages of the Egyptians are the same as those in the time of the Pharaohs; 'the Patagonians' rude shelter of leaves—the hollowed bank of the South African earthmen, we cannot conceive ever to have been inferior to what they are now.'

Mr. Wallace says that these various structures are not built by instinct, but by 'simple imitation' from one generation to another; and then he proceeds to abolish his entire argument by telling us that these various tribes had nothing else at hand wherewith to build themselves habitations. 'The turf, or snow, or stones—the palm leaves, bamboo, or branches which are the materials of houses in various countries, are used because nothing else is readily to be obtained. The Egyptian peasant has none of these—nor even wood. What then can he use but mud?'

And so, because these people build themselves

[1] *Int. Obs.*, vol. xi. p. 413

homes of the best structure with the best materials at their command, they are denied the use of reason or instinct in their construction. It is all the result of mere imitation! Will Mr. Wallace kindly inform us where the Egyptians who live in mud cottages found a copy to guide them in building the Pyramids? Are these structures the result of reason or mere imitation? Is there no mark of improvement between the mud cottage and these wonderful structures?

Man, as a reasoning being, accommodates his architecture to his wants, his means, his civilization, and the circumstances of his existence. The bird builds its nest in obedience to the operation of an innate instinct, which is directed, like the movements of man, by a Higher Power, and is so adapted to the purposes of its existence. But let us hear Mr. Wallace himself upon birds' nests:—

'Each species uses materials *it can most readily obtain*, and builds in situations most congenial to its habits.'

This is not true—it has not even a soul of truth in it. Every schoolboy knows that each bird selects particular materials, with which it always, when left alone, constructs its nest. The nightingale selects its leaves and twigs—the goldfinch its moss, and lichen, and feathers—the willow wren and chiffchaff their dried grass—the whitethroat its bents and lichens—the rook its sticks—the swallow its mud—the kingfisher its bones—not because these things occur in the immediate neighbourhood, but because they are impelled to do so by an instinct which they cannot resist. Fancy a swallow, as Mr. Wallace remarks, building its nest of mud *because* it finds it on the margin of the ponds over which it flies in search of food!—the rook because, in digging for worms, it comes in contact with roots and fibres! Not one word is said of the adaptation of the materials to the position or character of the nest—the mud to be used as plaster, the sticks to be laid across branches of trees as rafters! Then, again, in the situation of the nests we are told, gravely, 'The titmouse, haunting fruit trees and rocks, and searching in cracks and crannies for insects, is naturally led to build in holes where it has shelter and security, while its great activity and the perfection of its tools (bill and feet) enable it easily to form a beautiful receptacle for its eggs and young!'

But Mr. Wallace begins to feel an awkward difficulty—viz., that the swallow, or the wren, or the finch, or the tit, build all their nests in the same situation, of the same form, and with the same materials as their forefathers and immediate progenitors have done, without even having had the opportunity of *imitation*, like the human being. How is the difficulty to be got over? *First of all he denies the truth of the above*, as I have given it. He says it is '*always assumed without proof* and *even against proof*.' Cage-birds do not build nests, like those which they do when at liberty; and he thinks little 'Pecksy' and 'Topsy' learn how to build their nests when they are living in them! In case I should not be believed, I will give his own words; and mind, I am quoting all this simply because the paper has been commended by Dr. Hooker, the President of the great British Association for the Advancement of Science.

Mr. Wallace says: 'During the time they [the young birds] are learning to fly, returning often to the nest [a false fact in natural history, as every schoolboy knows—birds seldom or never return into a nest they have once left], they must be able to examine it inside and out! [as though they were going to pass through a competitive examination], and as their daily search for food invariably leads them among the materials of which it is constructed [another awful blunder in natural history], and among places similar to that in which it is placed [another awful blunder], is it so very wonderful that, when they want one themselves, they should make one like it?'

This puts me so much in mind of the wonderful whale story introduced by Mr. Darwin in his first edition, but prudently withdrawn in the second, of bears swimming about with their mouths open, catching flies, being gradually converted into whales, that I am inclined to think Mr. Wallace is ambitious of a similar immortality in trying to make us believe his wonderful tales of the self-education of young tom-tits.

Mr. Wallace does not believe in instinct because it must be innate, and therefore disturb 'Mr. John

Stuart Mill's sensationalism and all the modern philosophy of experience.' Mr. Wallace, however, thinks that birds' nests are built by the same mode of reasoning as that used by man in building his houses! 'I simply hold that the phenomena presented by their mode of building their nests, when fairly compared with those exhibited by the great mass of mankind in building their homes, indicate no essential difference in the kind or nature of the mental faculties employed!'

I have dealt with Mr. Wallace's arguments on their merits, and I have condemned them. Before concluding, however, let me do justice to that gentleman. In his later writings he has separated from Mr. Darwin at an all-important point—viz., the Creation of Man. Mr. Wallace does not believe that 'natural selection' could have effected this great work. His reasons for this are most potent; but I may say, *en passant,* they are equally applicable to the whole cycle of created things.

It is found, and will be demonstrated further on, that the difference between the brain of the savage and the civilized man, in size, is not great; and Mr. Wallace makes the pregnant remark that, as the savage has a larger brain than his needs require, it could not have been produced by natural selection. He also refers to the nakedness of man's skin, and to the different construction of his feet and hands, asking how, even though the construction of the hand and foot might have assisted the animal to stand erect, of what use would the erect posture be to the animal? He also alludes to the human larynx and ear, the latter of which is treated at length further on. Most thankful ought all scientific men be to Mr. Wallace for these unanswerable teleological remarks.[1]

But a word about the brain of the savage being larger than his needs. Mr. Mivart would call this 'anticipatory development.'

Does it not read to us another and a grander lesson? Does it not tell us that the savage has organs of mind which require development by education and civilisation? Can any language be plainer than that shown by the brain of the savage? Does it not show that these beings are not to be slain and exterminated because they are savage? Ay—plainer, I say, than language can describe or eloquence illustrate does this grand biological fact tell us that the savage has the means given him by his Creator by which the blessings of education can evolve within him the thoughts, the feelings, the actions, the responsibilities, and the hopes of civilisation.

[1] *Natural Selection*, p. 322 *et seq.*

CHAPTER XXI.

THE VARIATION AND NATURAL SELECTION ARGUMENT, CONTINUED.

Mr. Darwin's Supporters—Professor Huxley.

Professor Huxley's high position in the scientific world.—Has failed to prove the truth of Evolution.—Does not entirely accept the hypothesis of Darwin.—Follows Häkel and Herbert Spencer.—Embryology his great basis of argument.—Universality of oviparous reproduction. —The point disputed.—Protozoa.—Fishes in the earliest strata.—Had the Vertebrate type thus early been evolved? — Agassiz' opinion.—Closeness of structural affinity.—Supposed similitude of embryonic forms.—Difference between Man and Apes.—The greater difference between the highest and lowest Quadrumana disproved from Professor Huxley's own figures.—Objection to the Ape-Man evolution theory. — Mr. Huxley's psychological criticisms. — His illustration of reason and instinct unsound.—Objection to Mr. Huxley's style of argument.—The nature of the present contest, and the necessity for mutual forbearance between the advocates of opposite theories.

I NEED not say that this distinguished man stands foremost in the Darwinian and evolutionistic school. And Professor Huxley is a very different man from the crowd who write in our scientific journals, or are learned in the mysteries of pigeon rearing and all the tricks by which chickens and bull-dogs are made to vary.

Professor Huxley is a distinguished teacher of biology. He is a man of great originality of thought, a clear and able writer, and thoroughly conscientious in all that he says and teaches.

But, with all this, he occasionally allows his almost passionate belief in evolutionism and Darwinism to make him unjust to his opponents. Notably is this shown in the commencement of his recent article in the 'Contemporary Review' (Nov. 1871), in which he remarks :—

'And as time has passed by a happy change has come over Mr. Darwin's critics. The mixture of ignorance and insolence which at first characterised a large proportion of the attacks with which he was assailed, is no longer the sad distinction of anti-Darwinian criticism. Instead of abusive nonsense, which merely discredited its writers, we read essays which are, at worst, more or less intelligent and appreciative; while sometimes, like that which appeared in the "North British Review" for 1867, they have a real and permanent value.'

I am sorry that Mr. Huxley should have written the above passage, because the words 'ignorance,' 'insolence,' and 'abusive nonsense' are not terms which ought to be used in a scientific criticism. Further, they are manifestly unjust and untrue, for the opponents of Darwinism are among the highest men in the ranks of science—viz., such as Agassiz, Flourens, Owen, Haughton, &c.

The opinions of these men have hardly ever been noticed by the Darwinian school, and, in fact, it was only when two writers who may be termed seceders from its philosophy come forward, that Mr. Huxley rushed to the rescue. Like a skilful general he saw the significance of a virtual surrender by such men as Mr. St. George Mivart and Mr. Wallace.

Mr. Huxley's position in the Darwinian school is somewhat anomalous. In his principal work upon the question he remarks: 'I adopt Mr. Darwin's hypothesis, therefore, subject to the production of proof that physiological species may be produced by selective breeding, just as a physical philosopher may accept the undulatory theory of light subject to the existence of the hypothetical ether.'[1] This was published in January 1863, but in November 1871 the missing link had not been supplied, and yet we find Mr. Huxley expressing himself thus:—

'The gradual lapse of time has now separated us by more than a decade from the date of the publication of the "Origin of Species," and whatever may be thought or said about Mr. Darwin's doctrines, or the manner in which he has propounded them, this much is certain, that in a dozen years the "Origin of Species" has worked as complete a revolution in biological science as the "Principia" did in astronomy; and it has done so because, in the words of Helmholtz, it contains an "essentially new creative thought."'[2]

But Mr. Huxley goes much farther than the above

[1] *Man's Place in Nature,* p. 108.
[2] *Contemporary Review,* Nov. 1871.

partially expressed belief in Darwinism, and this may explain how he comes to be the great champion of the hypothesis, although but a partial believer in its truth.

He is a firm and uncompromising disciple of the doctrine of evolution, as formularised by Herbert Spencer and taught by Häkel.

His opinions are best expressed in his own terse language:—

'But now, leaving Mr. Darwin's views aside, the whole analogy of natural operations furnishes so complete and crushing an argument against the intervention of any but what are termed secondary causes in the production of all the phenomena of the universe, that in view of the intimate relations between man and the rest of the living world, and between the forces exerted by the latter and all other forces, I can see no excuse for doubting that all are co-ordinated terms of nature's great progression from the formless to the formed—from the inorganic to the organic—from blind force to conscious intellect and will.' [1]

Nothing, then, can be more explicit than the exposition of Mr. Huxley's views; but, until the missing link be found, which according to the experiments of Flourens it never can be, his position must remain anomalous. Mr. Darwin's 'new creative thought' cannot have any sound influence in biology, even if all other parts be true, unless 'physiological species may be produced by selective breeding.' Therefore I think

[1] *Op. cit.* p. 108.

we may logically decide that the value of his hypothesis is inferior to the 'Principia' of Newton.

No man in these enquiring days will long or permanently maintain a high position in the scientific world who constantly dogmatises upon an unproved hypothesis, on the *assumption* that it is true when the essential elements of its truth are wanting.

The question is: Can evolution, as it is understood by the Darwinian school, be proved? Can matter, by virtue of an inherent potentiality, and by secondary laws, evolve itself from the 'formless to the formed,' and so transmute, during ages of time, a mollusc into a fish—a fish into a mammal—and a monkey into a man?

The *onus probandi* of these great queries surely rests with those who answer them affirmatively. I confess that I have never yet heard a single proof established in their favour, and, until proof is given, it would, I think, be far more creditable for scientific men to confine themselves to a solution of the real issue.

Having stated this as my opinion, I freely admit that Mr. Huxley has expressed his own convictions with perfect good faith, and argued his case with most consummate ability; and if good faith and consummate ability and high standing in the scientific world could have settled the question, it must have been settled long ago.

But let us at once examine the basis of his faith.

The first facts upon which Mr. Huxley relies to establish his case are derived from embryology.

I have already expressed my own views upon the subject, but, at the risk of recapitulation, I must go over some of the arguments again.

Mr. Huxley says—

1. 'All animals, except the very lowest, commence their existence as an egg.'

Now, the exception here is far more important than the rule, inasmuch as it affects the great class of animals which must have existed, according to the evolution hypothesis, in the earliest periods of life upon the globe. I mean the great sub-kingdom of minute organisms—the Protozoa.

The Gregarinidæ, among the smallest of known animals, are not propagated by eggs; but their mode of reproduction is well known.

Two of the creatures, which can only be seen by the aid of a microscope, unite together—become mingled into one cell, which divides into two distinct parts, and each part separately develops its progeny. The two parts become one cell again, which bursts and distributes its young into the world. The great class of Infusoria are propagated by self-division or buds. The Rhizopoda or Amœbiform bodies, which include the Foraminifera and the early architects of the foundation of the earth's crust, viz., the *Eozöon Canadense*, and the Radiolaria, so well described by Huxley himself, are propagated in the same way; while the minute cell which constitutes the gemmule of the sponge has organs of locomotion by which it swims about until it finds its resting-place.[1] These facts are well known, and therefore Professor Huxley's remark that further inquiries may remove the apparent exception is hardly admissible as an argument, while the whole facts tell strongly against his theory, for they prove that the plan of creation in the lowest forms of life is different from that adopted in the higher, although we have already seen that the higher and lower and lowest forms of life occur in a fossil condition in the earliest known fossiliferous strata mingled one with the other!

And I might take my stand here and say that this plan of the development of the earlier form of life is fatal altogether to the assumption of continuous evolution. Perhaps, however, I should be accused of shrinking from meeting its supporters on higher grounds. Well, then, in the sub-kingdom Cœlenterata —among the Hydræ, for instance—we find that eggs, or ova, are first introduced as *one* of the means of propagation; but not only is this not the sole means, but we find that all through the sub-kingdom, and even into the Annulata, propagation may be accomplished by a species of budding without any sexual influence at all. So that the statement of Mr. Huxley that all animals, with a few exceptional cases, originate from an egg is not true in fact, and this is a very important break in his evolution series. Whence came the fishes pointed out

[1] Bree's *Lower Forms of Life.*

by Agassiz as having existed contemporaneously with species of all the invertebrate sub-kingdoms in what he calls the Taconic, or Sub-Cambrian, strata? This is the extreme limit of known geological strata in which life is found to have existed. Will Professor Huxley maintain for a single moment that in those remote spots in the vista of time—so remote that human reason cannot grasp or realise the distance—that the vertebrate skeleton had already been evolved *from the invertebrates* among which it is known to have existed? Crabs or lobsters, worms, cuttle-fish, snails, jelly-fish, star-fish, oysters, the polyps lived contemporaneously with the first known vertebrate animal that ever came into being—all as clearly defined by unmistakeable ordinal or special characters as they are at the present moment. And why, let me ask, does Mr. Huxley pass through the three lowest vertebrate divisions and more than half way up the fourth to illustrate the development of the embryo in the egg? Simply because the nearer we bring two individuals in the series to each other, the more similar is the 'method' of their development.

Has not Agassiz finely pointed out that the skeleton of the fish had been created with special reference to man himself? Is not the same plan pursued throughout in the development of the vertebrate series? Why, then, take such elaborate pains to show us that the embryos resemble each other at different periods of their embryogynal existence?

Could it possibly be otherwise if the remark of Agassiz be true? Creation is not by chance but by system, not by physical but vital laws; not the result of correlated force, but the product of intelligent and designing mind.

2. The study of development affords a clear test of closeness of structural affinity.

And upon this postulate Professor Huxley attempts to prove that 'the mode of origin and the early stages of the development of man are identical with those of animals immediately below him in the scale: without a doubt he is far nearer in these respects to the ape, than the apes are to the dog.'

Of course, the higher the organisms go up the scale, according to the evident *plan* of creation, the more do they resemble each other during development and in maturity. But the truly wonderful fact is kept in the background altogether by Mr. Huxley, viz., that these embryos, though so much alike, become developed into beings altogether different. What does this prove? Why, that the assumed likeness *is not real.* Each shapeless mass contains within itself the powers of development into two distinct and differently formed living things. This cannot be by the mere application of physical laws. There is something beyond which neither Mr. Huxley nor any other scientific man who ever lived can understand. And that something—the Why?—puts Mr. Huxley altogether out of court. No explanation upon the known laws of physics can explain why those two embryos—that of the dog and the man, or the ape and the man—which Mr. Huxley tells us are at certain periods so much alike, shall become afterwards developed into complex structures so different between the dog and the man, and intellectual faculties so widely apart between the ape and the man.

If they are, as Mr. Huxley says, at certain points *exactly alike*, then their development must be owing to the direct operation of supernatural causes. If they are only alike in external appearances, but totally unlike in their internal characters, then there is no force in Mr. Huxley's analogies, and all his labour to prove evolution from embryology is a vain and useless task.

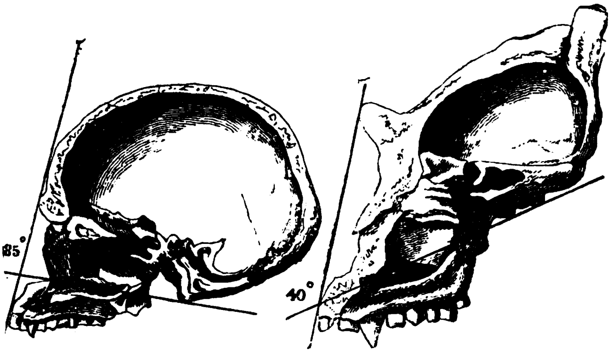
There is nothing more surprising in Mr. Huxley's attempt to prove his case than the confidence with which he tells us the 'startling' fact that the young ape is as far apart from the young dog as man is, while the latter, till within a short period of the close of his development, closely resembles the ape.[1] Exactly so! the last touches to the great picture which so greatly change its character are unintelligible to the amateur, who looks on with wonder and surprise at the skill and knowledge of the artist. And the last touches of the

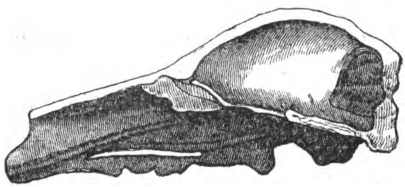
[1] It must be remembered that the dog is excluded from Mr. Darwin's line of human descent, and not only is the dog omitted, but all the Cetacea, most of the fishes, all the birds, and all the mammalia, except the lemurs and monkeys—all of which must have required, according to evolutionism, separate lines of evolution. See Table, Frontispiece.

Great Master Builder, who creates that which man could have inherited from no animal in existence —the intellect, the reason, the immortal and never-dying soul—these are equally misunderstood by the cold unimaginative speculating materialist, who looks on with no feeling of pride, or of wonder, or reverence at the stupendous fact which, though he cannot understand, he yet endeavours, with a bold philosophy and a baseless theory, to elucidate and explain.

It would be a waste of time to follow here Mr. Huxley's elaborate comparison between the anatomical structure of man and the lowest and highest of the apes, but there is one statement much relied upon by Mr. Huxley which requires some explanation, viz., that there is more difference between the highest apes and the lowest of the Quadrumana than there is between man and the highest apes.

Now I give a section of the skull of the lemur, after Huxley himself, and a similar section of the skulls of the gorilla and an Australian, the lowest human skull, after Owen. In a moment it is rendered evident that, as regards the size of the brain, his statement is not correct. And size of brain is the chief and all-important distinction between man and monkeys. It is the difference between reasoning man and the brute, as shown by the organ of reason itself. Mr. Huxley may point out analogies and homologies in the anatomical details which bring the organic structure of the two forms very close to each other; but these are merely means to the same end which are adopted to suit different modes of life and 'circumstances of existence.'





The lemur and the gorilla are monkeys, but man is essentially, and eternally, and finally distinct from both. Singularly enough Mr. Huxley, to prove his argument, utterly abolishes Darwinism, for he gives a section of the skull of a New World long-tailed monkey, having a more capacious brain capacity than the so-called man-like apes! which are chiefly distinguished by the broad and impassable gulf which renders man irreconcilably dissimilar. I need not allude to Mr. Huxley's lecture upon Protoplasm, which has been dealt with, unanswerably and unanswered, by Dr. Stirling. In his most recent article in the 'Contemporary Review' Mr. Huxley has written a defence of the metaphysical aspect of Darwinism. As this review is personally directed against two other individuals, I have no doubt but that we shall have equally able answers from them, and therefore it will be unnecessary for me to go at length into the subject here, more especially as it has already been dealt with, and must be further noticed in other parts of this work. I may, however, discuss the mode of argument by which Mr. Huxley attempts to evade the difficulty.

In order to prove that animals have the same faculties *in kind* as man, he furnishes us with the following illustration:—

Suppose a keeper goes out coursing with a greyhound in leash, and a hare crosses the field of vision, he becomes the subject of those states of consciousness we call visual sensations, and that is all he receives from without. Sensation gives rise to thought—first of the object which is at a certain distance, then of the object which memory tells him is a hare. Then follows an emotion—a desire to possess the hare; then a volition and an act—the loosing of the greyhound from the leash. And in these intellectual operations we have, as in every other, two sets of successive changes, one the physical basis of consciousness, which for the sake of clearness in discussion Mr. Huxley calls 'neurosis;' the other consciousness itself, which for the same reason he terms 'psychosis.' The former is or may be followed in all its complexities by the anatomist and the physicist; the latter can only be known to the man himself.

When the keeper was first trained to his work, every step in the process of neurosis was accompanied by a corresponding step in that of psychosis, or nearly so; but with practice, though all the steps of the neurosis remain, the psychosis in a great measure vanishes. The loosing of the dog follows *unconsciously*, or, as we say, without thinking about it, upon the sight of the hare.

Now the acts performed by the keeper in the first instance, viz., *neurosis* and *psychosis*, constitute ratiocination; and Mr. Huxley asks, 'Do they cease to be so when the man ceases to be conscious of them?' And Mr. Huxley says this depends upon what is the essence, and what the accident of these operations.

To elucidate his meaning, I will quote his own words exactly:—

'Now ratiocination is resolvable into predication, and predication consists in making in some way the existence, the co-existence, the succession, the likeness and unlikeness of things or their ideas. Whatever does this reasons; and if a machine produces the effects of reason, I see no more ground for denying to it the reasoning power because it is unconscious, than

I see for refusing to Mr. Babbage's engine the title of a calculating machine on the same grounds.'

And now let us see the conclusion which Mr. Huxley draws from this reasoning:—

'Thus it seems to me that a gamekeeper reasons, whether he is conscious or unconscious, whether his reasoning is carried on by neurosis, or whether it involves more or less psychosis.

'*And if this is true of the gamekeeper, it is also true of the greyhound.* The essential resemblances in structure and function, as far as they can be studied, between the nervous systems of man and the dog, leave no reasonable doubt that the processes which go on in the one are just like those which take place in the other.'

In the dog, continues Mr. Huxley, the nervous matter undergoes a series of changes *precisely* analogous to those which in man give rise to sensation, a train of thought, and volition.

Whether the psychosis is the same or not, Mr. Huxley adds, it is impossible to say; but at all events, if we deny 'that a dog thinks, there are no grounds for believing that he feels.' Now I think there can be no difficulty in proving that the psychosis in the man is totally different from that in the dog. The gamekeeper, by a process of ratiocination, comes to the conclusion that there is a hare before him, which can run faster than he can, but which he desires to catch. The dog, by its instinct, which has been developed more and more as he grew up from a puppy, sees what it knows is its natural prey, which it has a desire and means of catching. Reasoning man makes use of the instinct of the dog, which he has trained by his reason to attain great speed; and he therefore gains his object —the possession of the hare.

There is no more reason exhibited on the part of the dog in Mr. Huxley's illustration than there is in a dog running out of its kennel to get its food. If the dog cannot catch the hare, he gives it up as a failure; he does not, if left to his own devices, employ another dog to run faster than he does, which would be an act of reason like that of the gamekeeper. Again, although the man may do a reasoning act unconsciously, as Mr. Huxley says he does, as the result of education, there is no ground whatever for placing this unconscious reasoning upon the same level as the instinctive one of the dog. Mr. Huxley says that if a machine produces the effects of reason he can see no more grounds for 'denying to it the reasoning power, because it is unconscious, than for refusing to Mr. Babbage's engine the title of calculating machine on the same ground.'

Surely this is unsound reasoning. In the one case the man reasons out a result, and by practice repeats it without going over it again. The 'reasoning machine' would be merely the reflex of man's reason, acting by and in consequence of that reason. We might as well say that a musical box was a musician, and a composer of music, because it unconsciously performed a piece of music composed and adapted to its machinery by a musician. It matters not to the argument whether Descartes' opinion is true or not, that all animals are mere machines and devoid of consciousness. The question is, are man's mental powers different from those of brutes. Say that the latter acts by instinct; it is quite possible, and all analogies are favourable to the supposition, that the 'neurosis' necessary for human 'psychosis' may be in part the same as that which produces instinctive actions. Seeing that the result is so widely different, surely it cannot with any propriety be argued that such partial similarity gives to 'their reasoning processes a fundamental unity.'

Mr. Huxley asks, 'If monkeys are capable of sensation, emotion, and volition, why are they denied thought (in the sense of predication)?'

Our answer to this is simple enough, and ought to be conclusive enough; but I do not expect that any answer will satisfy Mr. Huxley, who remarks, 'No answer has ever been given to these questions.'

But surely we cannot give to monkeys a 'psychosis' which we know they do not possess. If monkeys do not reason in the sense that men do—and Mr. Huxley will hardly affirm this—surely it shows that sensation, emotion, and volition are not sufficient to constitute reason.

The reviewer in the 'Quarterly,' whose psychology is severely condemned by Mr. Huxley, defines the special mental powers of man to be 'self-consciousness,' and 'the reflection upon our sensations and perceptions, and asking what they are and why they are'—Reason.

None of these qualities given to animals by Huxley are included in the definition; and therefore Mr. Huxley, departing from that good taste which ought to mark the discussion of science, becomes personal, and indulges in language which is quite unjustifiable. 'Nay,' says Mr. Huxley, 'what becomes of an average country squire or parson? How many of these worthy persons, who, as their wont is, read the "Quarterly Review," would do other than stand agape if you asked him whether he had ever reflected what his sensations and perceptions are, and why they are?'

This is not the recognised mode in which scientific discussions are carried on. Mr. Huxley evidently misconceives the meaning of the writer's definition, and then casts a most unworthy and unjust slur upon the mental condition of a class of men who, with few exceptions, are quite able to meet Mr. Huxley on his own ground, although they may not be able to discern clearly that there is no fundamental difference in the mental qualifications of men and brutes.

On the whole I do not think that Mr. Huxley has added much to the proofs of Darwinism. He seems to lack the requisite calmness of temper to argue the question with equal fairness to those who agree with him, and those from whom he differs. After all there is a certain amount of respect due to the feelings, nay, even to the prejudices of our opponents in scientific discussions. Sound opinions lose nothing by being enforced with calmness and consideration for others, and if a different line is taken people are rather apt to look upon the aggressor as too self-confident both of his position and abilities. Neither do I think that Mr. Huxley has added any proof that the evolution of living things is the true mode of the incoming of species. It will be noted, however, that there are two distinct kinds of evolution advocated by different schools. That which is taught by Mr. Darwin, Mr. Huxley, and Mr. Herbert Spencer is founded upon the operation of physical forces and secondary laws, without the supervision and guidance of an exterior power. The other kind of evolution is adopted by Owen, St. G. Mivart, and such able writers as the reviewers of Darwin's work in the 'Edinburgh' and 'Quarterly Reviews' for 1871; and this is simply an expression that evolution is the mode of creation, and that the Creator is the ever-present and guiding Power by which it is perfected, and that such evolution may occur, and probably does occur, *per saltum*.

Now I do not believe that either kind of evolution is susceptible of proof; the latter, however, has much more to commend it to consideration than the former, and facts may hereafter give it that scientific precision which is requisite to establish it as the mode of creation. It will however still be special in its character.

All facts however—all probabilities—all proofs are, in my opinion, opposed to the evolution from 'blind force to conscious intellect and will'—or that which is the result of 'chance variation,' or the mere 'integration of matter.'

If the Creative Power does not preside over all the changes of His creation, if He does not guide, direct, and mould into shape, and call into being every living thing in the vast world, there cannot be the slightest probability that He endowed the primordial speck, from which they tell us all things have been evolved, with the potentiality of creating, as it were, all living structures in the world. Nor, on the other hand, will the great question be more readily solved by any one ignorant of science raising difficulties and assuming that the facts of science are untrue, because they appear to be opposed to revealed truth. A wider margin must be given to those who investigate the recondite mysteries of Nature, and the most liberal construction must be placed upon their deductions, if they at first do not appear to square with our own convictions. There is a struggle going on, but it is between the advocates of truth—not a war of bigots. Let us not carry our gifted reason beyond its limits, or attempt to solve erudite questions far beyond its reach. The history of the past gives us a rational hope that this reason may become still more gifted, and then we shall require no second light, nor higher intellect to explain much that is now dark. Science and religion, twin-sisters as they are, shall no longer be divided by doubt or mistrust; and the pride and self-glory now so apparent in even the loftiest efforts of human genius will pale before the grand light which truth shall send into every corner of the Earth.

CHAPTER XXII.

THE VARIATION AND NATURAL SELECTION ARGUMENT, CONTINUED.

Mr. Darwin's Supporters.

Sir Charles Lyell.—Conversion of Sir C. Lyell.—His labours great in Geology.—Charm in his earlier writings consisting in their genuine teleological tone.—The 10th edition of the 'Principles.'—The scene changed and the charm gone.—M. Gaudry.—His fossil discoveries. —Sir C. Lyell's comments thereon.—Facts in favour of Darwinism divided into five heads.—The Dryopithecus.—The Mesopithecus of Pikermi.—Difference between species defined by man and those defined by Nature.—The great law of species.—Absurdity of drawing great conclusions from slight or assumed differences between fossil and recent forms.—Illustration.—Variation in Time more or less constant as to size.—Häkel's 'Origin of Man.'—Sir C. Lyell's doubtful phraseology.—Mammalia, absence of, in far distant islands.— The Navara Lizard.

I HAVE pretty well exhausted the practical writers on Darwinism who have been considered to have advanced the argument during the last ten years. At all events, it is not necessary to dwell upon the lesser lights who glean their knowledge of science from the pigeon-loft, and essay deep onslaught upon special creation from the every-varying and endless changes which occur in the top-knots of Polish chickens or the spangled plumage of gold and silver Hamburgs. I turn to the Geological Record and will endeavour to cull from the pages of the stone book any facts which have told in favour or otherwise of Darwinism since the publication of the 'Origin of Species.'

The conversion of Sir Charles Lyell is, on the face of it, a great fact for Mr. Darwin. In all his editions of the 'Principles of Geology' up to the tenth, he looked upon geological phenomena and geological facts as proving the fixity of species and their special creation in time. In the tenth edition, just published, he announces his change of opinion on this subject and his conversion to the doctrine of development by law.

As in the 'Origin of Species' Mr. Darwin admitted that geology was his weakest point, the accession to his party of the Nestor of geologists—the man to whom the present generation is more indebted than any other for all that is known of geology in its advanced stage—must have been a great triumph, and was sufficient to justify the allusion made to it by Dr. Hooker in his address at the Norwich meeting of the British Association.

I must confess that a tinge of regret passed through my mind when I saw the veteran form of this fine old man walk up the geological section room, and when I thought of the pleasure with which in past days I had read his works and imbibed the healthy tone and spirit in which they were written. I felt, I say, a tinge of regret when I reflected that such a man could, in the maturity of his age and fame, have forsaken the 'principles' of his youth, of his manhood, and of his prime.

The charm with which years ago I had read the 'Principles of Geology' had passed away, and it was with a feeling of melancholy that I reflected what the future would think of the great geologist's transmutation of thought.

Let us, however, look into the tenth edition and ask the important question, Has this change of opinion added one single link to the chain of reasoning by which the advocates of progressive development and blind force evolution try to prop up their creed? I think not. Sir C. Lyell has recapitulated all Mr. Darwin's principles, and has added all that he knew which he thought might support his old friend's views. But the tenth edition of the 'Principles' adds no new prop to the already tottering heresy. It does nothing to supply the missing links by which the stone book ought to *prove* the truth of evolution. It takes refuge in the now old old story, that the records of that stone book are imperfect—although Agassiz, as we have seen above, has proved how much richer in species the old strata are than the present seas.

In spite of the great researches displayed by the magnificent works of the Palæontographical Society—in spite of the proof adduced by Agassiz that the lowest fossiliferous strata contained representatives of all the typical animal structures known in the great animal sub-kingdoms—in spite, in fact, of the well-known riches of geology—we are again told that its records are too imperfect to have any weight in solving the mystery. The following are, however, the principal facts recorded by Sir Charles. M. Gaudry has written a treatise, and Sir C. Lyell, with the avidity of a new convert, has seized upon him to prove that geology shows us intermediate forms between the Upper Miocene and living mammalia.

'Having myself,' says Sir C. Lyell,[1] 'had the advantage of seeing the original specimens collected by this zealous geologist, and now in the museum of Paris, and having had the connecting links supplied by species obtained from other parts of the world laid before me, I have been able the more fully to appreciate the force of the evidence appealed to in favour of transmutation.'

These facts in favour of Darwinism are—

1. Animals with a proboscis have been arranged in chronological order in the form of thirty distinct species, 'beginning in the Middle Miocene and continued through those of the Upper Miocene of Ava, the Sewalik Hills, Pikermi, and Eppelsheim, to the Pliocene forms of Southern India, Italy, and England; finally to the Post-Pliocene or quaternary species of Europe and America, till we end with the two existing elephants of India and Africa.'

2. Fifteen extinct species and five existing ones of the rhinoceros are tabulated in the same form.

3. The horse is traced from the Upper Miocene of

[1] *Principles*, ii. p. 482

France, Germany, Greece, and India, through the Pliocene and Post-Pliocene of Europe, India, and America, to the living horse and ass.

4. The Pig family have also shown ample materials in illustration of the same law of a gradual change of structure.

5. Even the Quadrumana are beginning to afford proof of the manner in which the existing apes have ramified from their extinct prototypes, although our information respecting them, whether from Pikermi or elsewhere, has been almost exclusively hitherto derived from extra-tropical latitudes, where there are now no living representatives of the order. 'Only fourteen species of the ape and monkey tribe have as yet been detected in a fossil state, and each of these has usually furnished but a few bones of its skeleton to the osteologist; yet they have not failed to throw much light on the transmutation hypothesis.' (P. 483.)

'The Dryopithecus of the Miocene south of France, specifically distinct from any ape now existing, comes so near the living gibbon, or long-armed ape, as not, according to Owen, to deserve separate generic rank.

'All the other fossils of Europe and Asia have an affinity to living species or genera of the Catarrhine division, and those of America found in Brazilian caves to the Platyrrhine.' (P. 484.)

Sir C. Lyell then quotes M. Gaudry's rhapsodies, because the Mesopithecus of Pikermi differs from any fossil types in having skulls like the living Semnopitheci of India, and limbs like those of the Macaques. And then M. Gaudry exclaims, 'How clearly do these fossil relics point to the idea that species, genera, families, and orders, now so distinct, have had common ancestors!'

Now, the great error which is committed by M. Gaudry, by Sir C. Lyell, by Mr. Darwin, and others of the school, is this—they have made no difference between the species defined by man and those which are defined by Nature. In classification, as pursued by man, every little alteration in external character or habit is deemed sufficient to constitute a species; but Nature has nowhere created two organic beings exactly alike, and we frequently witness variations or sports which make her productions still more unlike each other. She has, however, instituted a grand law, which Flourens has tersely expressed: 'Continued fecundity marks the species, but limited fecundity marks the genus.'

Mr. Darwin has not been able to disprove this axiom, and therefore he is, according to Mr. Huxley even, altogether out of court.

But how absurd it is to take the bones of a series of monkeys, or other animals, in a fossil state, and attempt to prove the theory of transmutation from their real or assumed difference from living forms!

Let me illustrate this. Suppose we take the members of the British Association who will meet together next year, and measure the length, breadth width, and circumference, and calculated brain-capacity of each member; let us carefully measure the length of each member's nose, arms, hands, fingers, legs, feet, and toes; let us note down the colour of their hair and its consistency, of their skin, eyes, and the hirsute or nude condition of the former. Why, with these data, we shall find at least fifty different species formed according to the plan pursued by M. Gaudry and Sir C. Lyell in determining the different specific characters of the Miocene and existing monkeys; and yet no one doubts the members of the British Association being one species.

Again. Let us imagine for a moment that the whole inhabitants of the world were to be momentarily destroyed except the British Association, and that these learned savants were permitted to enjoy a millennium of scientific research. How many species would they make out of the human fossilised race at the end of their millennium?

And suppose that these savans, during their millennium, were to be altered slightly by variation, as we see the Americans alter from the English; would they not with triumph produce a paper proving that they were descended from the fossilised species of men, but that they showed distinct signs of transmutation —for one series of fossils had longer legs or arms, or broader or longer skulls than their living prototypes? And yet this is exactly the argument assumed by Sir C. Lyell, on the authority of M. Gaudry, to prove the transmutation of apes.

How variation in time affects a species, I am able to show from fossils in my own possession.

At the Norwich meeting, the Rev. Osgood Fisher read a paper upon the Norfolk Drift; and he described the upper of the three layers as identical with the fossiliferous fresh-water clay-beds at Walton-on-the-Naze in Essex; and he assigned a probable age to this formation of somewhere about 110,000 years.

Now, I have fossils found together in this bed at Walton: elephants' tusks and teeth, skulls and horns of the Irish elk (*Megaceros hibernicus*), bones of *Bos primigenius*, and teeth of the woolly rhinoceros (*Rhinoceros tichorhinus*)—all extinct species; but among them I have two fine frontlets, one of them with horn cores, of the *Bison priscus* or Auerochs, representatives of which are still alive in Europe, viz., in the Caucasus and Lithuania.

Professor Owen says [1] that the fossil species does not structurally differ from the living one; but my fossils prove that the ancestor was larger than its living descendant: in other words, in 110,000 years the species has from various causes become degenerated, and will probably, judging from analogy, in a few hundreds of years die out. But we do not see here any sign of transmutation. External causes have altered the size of the creature, but its specific distinctness from its congener, the buffalo, remains the

[1] *Fossil Mammalia.*

same in the living as it is shown to be in the fossil remains

But the savants to whom I have alluded have been anticipated. Professor Häkel, of Jena, has already divided the human race into no less than ten different species, and has given his view how they have been 'evolved.' I copy the following from the 'Quarterly Journal of Science' for 1868.[1]

'In the first essay, "On the Origin of Mankind," the author gives his reasons for inferring that Man has come into being by a process of development from the lower animals; and he regards the importance of the "Lamarck-Darwin" hypothesis as precisely equivalent to that of Copernicus and Newton's system of astronomy; for, while the latter proved the error of the old geocentric system, so the former shows the falsity of the Anthropocentric belief that looks upon man as the centre of an animate world created only to supply his wants.

'The second essay, "On the Pedigree of Mankind," contains the author's opinion of the line in which man's development from the lower animals took place. Commencing with Amphioxus, and proceeding through the lampreys and the extinct allies of the sharks to the Lepidosiren, thence through Proteus and its con-

[1] Dr. Häkel on *Origin of Man*. From 'Ueber die Entstehung und den Stammbaum des Menschengeschlechts,' by Dr. Häkel, in the *Sammlung gemeinverständlicher wissenschaftlicher Vorträge*, herausgegeben von Rud. Virchow und Fr. v. Holtzendorf, Serie iii. Hefte 52, 53. 1868.

geners to the Tritons and Salamanders, and then to the Monotremata (Ornithorhynchus), the line then passes through the Marsupials, the lemurs, the Old World monkeys (Semnopithecus, &c.), and the anthropoid apes (orang, gorilla). As will be seen further on, this is precisely the line taken by Darwin.

'All the existing varieties of man the author regards as having come from one stock, but that original race he considers to be now extinct. He also believes that the various races have the same value as natural history species, and as species he describes them. They are the following:—

'I. *Homines ulotrichi:* Men with woolly hair and long heads.

1.	Homo primigenius .	Ape-like men, now extinct.
2.	H. Papua . . .	Papuan species.
3.	H. hottentottus . .	South African species.
4.	H. Afer	Central African species.

'II. *Homines lissotrichi:* Men with smooth hair; heads long, short, and of medium proportions.

5.	Homo alfurus . .	New Holland species.
6.	H. Polynesius . .	Malayan species.
7.	H. Arcticus . . .	Polar species.
8.	H. Mongolicus . .	Yellow species.
9.	H. Americanus . .	Red species.
10.	H. Caucasicus . .	White species.

He does not deny that it is sometimes difficult to draw the line between these groups, but observes that the same difficulty exists in treating of species belonging to other groups of the animate world.'[1]

Sir Charles Lyell has told us that Linnæus could not distinguish man generically from the ape. Had Linnæus taken into his calculation the peculiar anatomy and function of the human knee-joint, the peculiarly and adaptively curved spine which enables man to stand upright, and the grand cerebral differences, he would have had no difficulty in placing man by himself, the sole representative of the genus Homo, the highest effort of creative power among living things. Sir C. Lyell does not shine as a transmutationist, and every now and then we find him turning back to the old sentiments which gave a peculiar charm to his former works. Take, for instance, one of his concluding passages: 'But in whatever direction we pursue our researches, whether in time or space, we discover everywhere the clear proofs of a Creative Intelligence, and of His foresight, wisdom, and power.'[2]

Strangely contrasted with this fine passage is the following hesitating, doubting, uncertain expression of transmutation (the italics are mine):—'There must ever have existed, according to the theory of natural selection, all the transitional forms between the two extremes; but these forms *may* have died out for want of favourable conditions, or *may* have been absorbed into one or other of the extremes; which

[1] *Quarterly Journal of Science*, October 1868, p. 551.
[2] *Op. cit.* p. 613.

last *may* be able to maintain their ground, on the principle before alluded to.'[1]

All this is a very weak kind of reasoning, but it prevails throughout that part of the work which is devoted to an exposition of Mr. Darwin's views. I will select a few more instances from the chapter on 'Insular Floras and Faunas,' considered with reference to the origin of species:—

'It is also *possible* that some volcanic islands *may*, during or since the Miocene era, have been formed and again destroyed within the area of the map (showing the depth of the ocean between the eastern volcanic archipelagos of the North Atlantic and the mainland). They *may* have played an important part in promoting the interchange of species between different archipelagos, or between them and the continent.'

And with this uncertain strain he introduces us to the animals in the above islands, which he wants to prove have never been formed there by transmutation.

Mammalia.—These, as indigenous species, are all absent, except bats; but we do find in the Grand Canary and Teneriffe islands no end of domestic animals—camels, horses, asses, dogs, sheep, and pigs, but no little squirrels, or field-mice, or weasels. Sir Charles then quotes Pritchard to prove there were no indigenous quadrupeds except bats in the Pacific Islands, and in New Zealand only three, two bats and one rat. Therefore, says Mr. Darwin, and therefore, re-

[1] *Op. cit.*, p. 424.

echoes Sir C. Lyell, 'the absence of all mammalia in islands far from continents is strongly confirmatory of the origin of species by descent from pre-existing closely-allied species.' (P. 412.)

But then why, with plenty of food in those islands for the support of any number of mammals, did they not flourish, and vary, and select, and have 'survivals of fittest,' and become, in fact, grand models of Darwinism? Sir C. Lyell admits that those volcanic islands were thrown up in the Miocene period, which is an immense era down the vista of time. Why did we not have evolved in those islands multitudes of creatures, to live upon the good things there provided for them? And surely those islands, so long left to themselves and to the operation of physical forces, ought to have produced some of those intermediate forms which would have displayed the links of transformation.

Let us be just. Is the 'Tuatara or Navara Lizard,' recently found in New Zealand, a case in point? It has, we are informed by Dr. Günther, teeth-like processes on the jaw-bones like the crocodile; the teeth proper are like the chisel-shaped incisors of a rat; the vertebræ are concave on both aspects like those of a fish, and each rib has a process attached to it similar to that of a bird; and, says Dr. Günther, these peculiarities of structure are more significant 'as the animal occurs in a part of the globe remarkable for the low and scanty development of reptilian life. The

New Zealand of the present period is inhabited by only a few (about nine) small species of generally distributed geckos and skinks, and a single species of frog; and it is not probable that this small list will be considerably increased by future researches. With more confidence we may look forward to discoveries of remains of extinct forms.'[1]

This curious reptile was in the Zoological Gardens in November 1868; but, as Mr. Tegetmeier ('Field,' November 7, 1868) says in characteristic Darwinian language, 'it is, like the moa and dodo, slowly and yet surely being *improved* out of existence by human agency.'

I have no doubt but that the transmutationists will make the most of this creature. We know at present too little about it to say whether its evolving powers are directed towards the bird or the rat, or whether, if permitted to remain, it will not become more crocodilian, or degenerate backwards and become a fish again! If the New Zealand pigs will only let it alone it will have a chance, in myriads of years, of arriving at one or other of those conditions!

Such, then, is all the evidence which the Atlantic or Pacific Islands can afford of the transmutation theory. Under the most favourable circumstances possible to conceive, their evidence upon the subject is entirely negative. And I think we need not follow Sir C. Lyell

[1] *Transactions of Royal Society.*

any further in his tenth edition of the 'Principles.'[1] He has adduced but little which has not been equally if not better said by Mr. Darwin. He has not added any geological facts worth recording in favour of transmutation, and he has left unanswered the proofs adduced by M. Agassiz, that the geological record is entirely in favour of the special creation of organic beings upon a fixed plan, only altered by Divine Wisdom to adapt them to the ever-changing circumstances of existence, and which display in every blade of grass that grows, and every living thing that peoples the earth, the waters, or the atmosphere, the marks of a designing, ever-acting mind, and the eternal and everlasting proof that the Creator is also the Providence of the World.

[1] The eleventh edition has been published since the above was in type. I have not seen it.

CHAPTER XXIII.

THE DERIVATIVE DOCTRINE OF PROFESSOR OWEN.

Professor Owen's statement that he has held the doctrine of 'Derivation' for thirty years.—His present belief is in a Law of Variation *ab initio*.—The Hipparion.—Professor Owen's vital difference from Darwin.—His strong language towards Sir C. Lyell and Professor Huxley.—Summary of Differences between Darwinism and Owenism:—No stronger *proof* of Derivation than of Darwinism.—Professor Owen's doctrine a surrender of outposts to the enemy.—He does not remove a single difficulty.—Difficulty or impossibility of the finite mind grasping the Infinite.—The Vertebral type in time.—Method in Creation.—The wisdom, the power, and the goodness of God.—Law not paramount to the lawgiver.—The Book of Nature a sealed book.—Probability of the seal being broken.—Rules of action in unravelling the great scheme.

In the concluding portion of the third and last volume of the 'Anatomy and Physiology of Vertebrates,' published in December 1868, Professor Owen has made a 'confession of his faith' in regard to the question of the 'origin of species.'

To all students of natural history, and particularly of the works of the author himself, this 'confession' will cause but little surprise, for although the theory of Professor Owen is somewhat different from that 'outcoming' which they had been led to expect, yet the frequent mention of a 'secondary law' in his writings, and his distinct assertion that he has held the doctrine now enunciated for the last thirty years, shows clearly enough that such a 'law' was part of the theory held by Professor Owen as to the 'origin of species.'

Professor Owen now states that he believes in the formation of species by secondary causes, acting continuously and progressively; and although, as will be seen, he does not discard the operation of an ever-present creative intelligence in the changes he assumes to occur in living organisations, yet he expresses his disbelief in special creation, or as he, I conceive, erroneously terms it, 'miraculous creation.' He believes that all species have been formed by the slow operation of a law of variation, imprinted upon matter by the Creator in the beginning, and that all living things have been produced by the operation of such law in time, their position and uses in the world having been pre-ordained by the Creator.

Professor Owen considers that the missing geological link in one great chain of organisms has been found, by the discovery of the hipparion;[1] which, he says, connects the paleotherium, as restored by Cuvier, with the horse of the present day; and he gives drawings of the leg and three-hoofed foot of the paleotherium, the one-hoofed foot (and two dwarf-hoofs) of the hipparion, and single-hoofed (with hoof-less splint-bones) foot and leg of the existing horse.

Professor Owen differs altogether from the 'natural

[1] 'Lettre sur l'Hipparion,' in *Annales scientifiques et d'Industrie du Midi de la France*, 8vo. 1852.

selection' theory of Darwin, and says some severe things of that naturalist. He thus condemns a distinguished naturalist for finding fault with Lamarck: 'From one destitute of qualifications for grappling with the difficulties of this profound genetic problem in physiology, silence would have been blameless. Vituperative condemnation by such a one of a given phase or an untenable ground of that problem, is of no greater value than his extravagant commendation, with as little capacity for comprehending its weakness, of a subsequent attempt towards its solution.' (Vol. iii. p. 802.)

Another well-known believer in Darwin is thus spoken of: 'To suppose that co-existing differentiations and specialisations, such as equus and rhinoceros, or either of these and tapirus, which have diverged to generic distinctions from an antecedent common form, to be transmutable one into another, would be as unscientific, not to say absurd, as the idea which has been bolstered up by so many questionable illustrations, *and foisted upon poor "working men,"* of their derivation from a gorilla!'

Professor Owen calls his secondary law that of 'derivation,' and thus sums up its difference from and superiority to the 'natural selection' of Mr. Darwin:

'"Derivation" holds that every species changes in time, by virtue of inherent tendencies thereto. "Natural selection" holds that no such change can take place without the influence of altered external circumstances educing or selecting such change.

'"Derivation" sees among the innate tendency to change, irrespective of altered surrounding circumstances, a manifestation of creative power in the variety and beauty of the results; and in the ultimate forthcoming of a being susceptible of appreciating such beauty, evidence of the pre-ordaining of such relation of power to appreciation. "Natural selection" acknowledges that, if ornament or beauty in itself should be a purpose in creation, it would be absolutely fatal to it as a hypothesis.

'"Natural selection" sees grandeur in the "view of life, with its several powers, having been originally breathed by the Creator into a few forms or into one." "Derivation" sees therein a narrow invocation of a special miracle, and an unworthy limitation of creative power, the grandeur of which is manifested daily, hourly, in calling into life many forms, by conversion of physical and chemical into vital modes of force, under as many diversified conditions of the requisite elements to be so combined.

'"Natural selection" leaves the subsequent origin and succession of species to the fortuitous concurrence of outward conditions. "Derivation" recognises a purpose in the defined and pre-ordained course due to innate capacity or power of change, by which homogeneously-created protozoa have risen to the higher forms of plants (?) and animals.

'The hypothesis of "derivation" rests upon conclusions from four great series of inductively established facts, together with a probable result of facts of a fifth class; the hypothesis of "natural selection" totters on the extension of a conjectural condition explanatory of extinction to the origination of species, inapplicable in that extension to the majority of organisms, and not known or observed to apply to the origin of any species.' (Op. cit. pp. 808, 809.)

Professor Owen thus expresses his belief in his secondary law:—

'Thus, at the acquisition of facts adequate to test the moot question of links between past and present species, as at the close of that other series of researches proving the skeleton of all vertebrates, and even of man, to be the harmonised sum of a series of essentially similar segments, I have been led to recognise species as exemplifying the continuous operation of natural law or secondary cause—and that not only successively but progressively—from the first embodiment of the vertebrate idea under its old ichthyic vestment, until it became arrayed in the glorious garb of the human form.' (Op. cit. p. 796.)

This passage follows one in which Professor Owen admits the 'weakness' of believing that the horse was 'predestined and prepared for man;' and in other parts of these 'general conclusions' he states unmistakably his belief in the constant operation of creative power in the formation of species from the varied descendants of more generalised forms.

But Professor Owen, by the adoption of his theory of 'derivation,' admits his belief that species are not fixed, as the experiments of Flourens and others so incontestably prove. The Creator may operate in the way indicated by Owen in the formation of species, but we have no more proof of it than we have of the hypothesis of 'natural selection' of Darwin, or that of 'evolution' of Mr. Herbert Spencer. That the 'archetype skeleton' should have culminated in the 'derivation' theory is not a matter of surprise; but that a man of Professor Owen's large knowledge should argue that there is an *innate* tendency in living organisms to pass into permanent and different ones, so as to form species, and give origin to the belief that the 'horse, the rhinoceros, and tapir have diverged to generic distinction from an antecedent common form' (p. 797), is, in my humble opinion, a surrender of the outposts of our defence to the believers in the Darwinian hypothesis.

But Professor Owen is as far off as ever in elucidating the great question, 'How works the derivative law?'. He examines the Lamarckian notion of 'the influence of the circumstances connected with the habits and actions of animals, and of the actions and habits of their living bodies as causes which influence and modify their organisations.' And he looks into Darwin's view of the 'struggle for existence,' and Geoffroy St. Hilaire's 'ambient medium;' but he regards all these 'vague generalities' as having prejudiced 'calm and sound judgment against any acceptance of or favour towards the grounds of a belief in secondary creational law;' and so, being unable to accept the volitional hypothesis of Lamarck, the 'ambient medium' of Geoffroy St. Hilaire, or the 'secretive force exerted by outward circumstances,' he falls back upon the simple answer to the question: '*I deem an innate tendency to deviate from parental type, operating through periods of adequate duration, to be the most probable nature or way of operation of the secondary law whereby species have been derived one from another.*' (Op. cit. p. 807.)

Professor Owen, by his 'confession of faith,' does not remove a single difficulty, or add one single proof towards the solution of the question as to the origin of species. Few people, especially among men of science, believe that they came into being by 'elemental atoms having been commanded to flash into living tissues.' There is a plan, a method, a forethought, an adaptive design in the works of creation, which speak truly enough of the love, the goodness, the wisdom, and the power of the Creator. How He has produced the varied masses of life which people the earth; how He has caused some to become extinct, and others to assume new and varied forms; how, in fact, He has created species as they appear in their new forms since the creation of the world, men of science know not. Will the problem ever be solved? Can the finite human mind grasp the workings and actions of the Infinite? Is the question of creation a 'thinkable' or a 'solvable' problem? Far down the eons of time—so far remote that its distance cannot be realised in the mind—is to be found the type of the vertebrate skeleton in what Owen calls its 'ichthyic vestment.' There, myriads upon myriads of ages ago, the Creator laid down the plan of man's corporeal frame. How grand and sublime the prospect! and yet how mysterious and unintelligible to our human capacity! We can see the skill of the Architect in His great plan; but the work of the Builder is hidden from human ken.

Science has *not* solved the question of the Creator's mode of creation. 'Transmutation,' 'evolution,' 'derivation' have each their share of disciples; but they are essentially different from each other, and the most profound human wisdom is powerless to decide which unproved hypothesis contains within it even a probable soul of truth. We know that the Creator in the beginning created all things, and we know that in time vast series of living things have ceased to be, and that unnumbered hosts have come into being; but HOW these grand cosmical changes have been brought about, we as yet know not. But we do know that in the formation of species there is shown an intelligent, omnipotent, pre-ordaining, providential, and designing Power.

We know that in creation there has been method and plan, the investigation of which is one of the legitimate objects and ends of science. She has done much in this grand work, and her favoured sons have not waxed faint in the battle, nor been appalled by the difficulties ever intruding into their path. The charm of such studies is the evidence met with at every step of a WISDOM which is not earthly, and a POWER and GOODNESS which throughout nature are supreme. Let us not relegate such attributes to mere force, or believe that LAW is paramount to the LAW-GIVER. In such case we should have nothing upon which to rely except the cold, mechanical, or so-called logical explanations of forces brought into being or action by a power which we cannot recognise as His by whom all things were created.

Man, who was formed in His image, with a reason and intellect which solve the grandest and most elaborate problems, cannot contemplate himself and his position in nature—his wonderful organisation, his intellectual perceptions, his consciousness, his reason—without admitting that the means by which Creative Wisdom placed him where and made him what he is, are in a sealed book.

CHAPTER XXIV.

MR. DARWIN'S LINE OF DESCENT.

Mr. Darwin's line of descent taken from Häkel.—The animal-like larva of Ascidian.—Kowalevsky's researches.—Confirmed by Küpffer, utterly denied by Donitz.—Uncertainty of microscopic investigations, according to Dr. Royston-Pigott.—Unfair review of Donitz: paper in the 'Microscopical Quarterly Journal.'—The Amphioxus.—The Lepidosiren.—The Ornithorhynchus.—The Kangaroo.—Mr. St. G. Mivart's argument against Natural Selection.—The Lemur.—The Simiadæ.—Man-likeApes.—Ape-likeMan.—Man.—Enormous amount of guessing in Darwin's human pedigree.—Ignorance of Science.—Enormous difficulties in tracing a human pedigree.—Strain upon credulity producing bad results.—Thomsonian Moss.—Speculative Philosophy.—Danger to Science.—Triumph of the True.

HAVING discussed the theories, and I trust exposed some of the fallacies, in the philosophy of Mr. Darwin, it remains for me to make a few remarks upon the line chosen by that gentleman, along which he conceives the Descent—or rather the Ascent—of Man to have run, and the presumed relationship of certain larvæ of ascidians with the embryological condition observed in the development of certain Vertebrata.

Mr. Darwin, however, must not bear all the responsibility of this line of descent, inasmuch as it belongs to the evolutionistic school, and originated with Professor Häkel of Jena. Mr. Darwin, however, has adopted the supposition, as we find in the following words:—

'At an extremely remote period a group of animals existed, resembling in many respects the larvæ of our present Ascidians, which diverged into two great branches—the one retrograding in development, and producing the present class of Ascidians; the other rising to the crown and summit of the animal kingdom, by giving birth to the Vertebrata.'

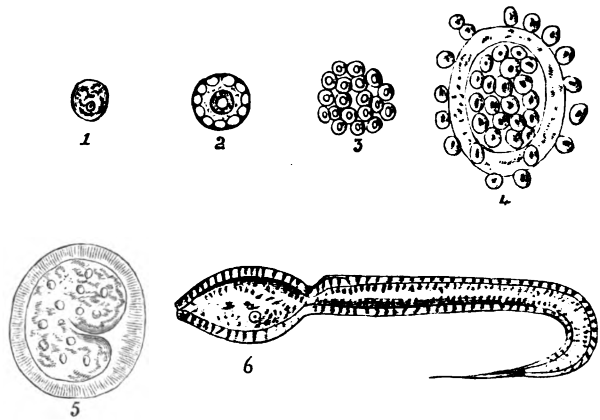


FIG. 6.—DEVELOPMENT OF SIMPLE ASCIDIAN.
1—5, Egg in different stages. 6, Larva. (After Beneden.)

In other words, this larva, Fig. 6, represents the form of man's early progenitor among the Invertebrata. Now let us see upon what basis this statement rests.

In 1867 Kowalevsky published, in the Transactions of the Imperial Academy of St. Petersburg, a paper detailing his observations upon the larvæ of several ascidians, more especially *Phallusia mammilatica* as to the early forms, and *Ascidia intestinalis*, a stalked species, as to the metamorphosis; and a very good abstract of Kowalevsky's observations is given, with illustrations, by Professor Michael Foster in the tenth volume of the 'Quarterly Journal of Microscopical Science' (1870), p. 59. To this paper is appended a note from Professor Küpffer of Kiel to Professor Max Schultz of Bonn, stating that he did not at first believe Kowalevsky's descriptions, but that during the summer of 1869 he had made numerous researches, and watched the transformations of the larvæ of *Phallusia canina*, and that these researches had completely changed his opinions, as they verified those of Kowalevsky. In 1870, Professor Küpffer published a paper in Schultz's 'Archives,' part ii., very well illustrated with three plates, detailing the above experiments at length. 'The larvæ eggs are placed in a watch-glass full of sea-water, for observation under the microscope, a low power being used, the chief difficulty being to catch the required view of the ovum at the particular stage in its early development which may be desired, since the changes proceed rapidly.'

Now I do not presume to criticise these experiments, not having tested them myself. But I wish to draw attention to the fact that Kowalevsky has been detected in one notable error before alluded to,[1] and up to this time I am not aware that these observations have been confirmed by any other naturalist. On the

[1] Cf. Proc. Zool. Soc. part i. 1871.

contrary, as we shall see presently, they have been utterly denied by one good observer. But what do they really amount to, if true? A certain similarity of changes which take place in the egg of the ascidian to those which are known to obtain in the Vertebrata; and hence, say the observers, there must be a genetic, or, as Küpffer calls it, a phylogenetic relation between two circles of life hitherto considered distinct. Mr. Darwin, of course, has gladly seized hold of the only bridge that would help him over the gulf. He did not take the trouble to enquire if the pillars of the arches were built upon a solid foundation, but at once marched over with a flourish of trumpets. And yet, what are the observations? Simply changes supposed to have been seen in a small egg in salt water in a watch-glass, *through a microscope*—one of the most difficult and uncertain means of observation, requiring constant attention, with every chance of error in microscopical investigation, intensified by the circumstances of the case. The microscope itself is open to sources of error recently unsuspected.[1] Dr. Donitz has written a paper in the 'Archiv für Anatomie und Physiologie,' Reichert and Du Bois-Raymond, Berlin, entitled, 'On the so-called Chorda of the Ascidian Larvæ and the alleged Affinity of the Invertebrate and Vertebrate Animals.' In this article Dr. Donitz demonstrates that Kowalevsky and

[1] Cf. Dr. Royston-Pigott's researches, in *Quarterly Journal of Microscopic Science* for April and July, 1871.

Küpffer are altogether wrong, and that the development of Ascidians is strongly opposed to any affinity of the Invertebrata and the Vertebrata. Of

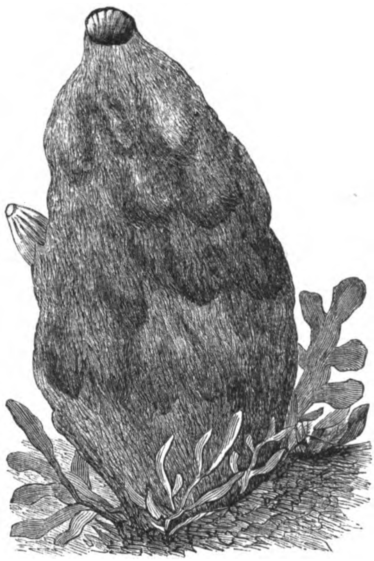
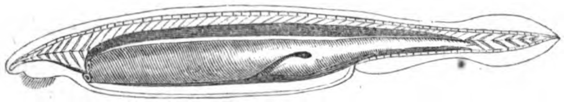
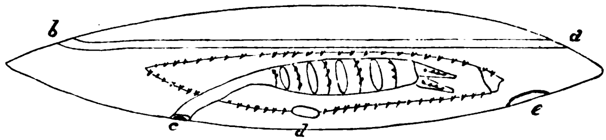


Fig. 6*.—Simple Ascidian, as found on our sea-shores. The upper orifice is the mouth; the lower one the anus shut. The covering is sometimes mammillated as above, at other times reticulated, and sometimes finely covered with sand. The name is derived from ἀσκός, a skin bottle; and they are known on our sea-shores as 'squirts.' (See pp. 181–183 ante.)

course, Dr. Donitz is loudly denounced by the Darwinian school; and a fine example of their partial mode of criticism, and of its scientific ill-nature, will be found in the 'Quarterly Journal of Microscopical Science' for July 1871. Such reviews as these, so evidently partial and incomplete, do much to lower scientific discussions. Why did not the editors give Dr. Donitz's paper the same chance which they did to those of Kowalevsky and Küpffer, by inserting a fair abstract? Partisanship of this kind will do no real good to Darwinism; on the contrary, it will diminish the respect which opponents ought to feel towards each other in the ranks of scientific enquiry. But it must be remembered that upon the supposed discoveries of Kowalevsky and Küpffer Mr. Darwin has founded the early invertebrate phase of man's ancestors! Therefore, if Donitz is right Darwin is wrong; and, consequently, his statements are received with misplaced and unscientific and unpardonable ridicule.

The next phase in Mr. Darwin's human genealogy is the *lancelet* or *amphioxus*. This is the lowest known vertebrate animal classed with the fishes; and, according to Kowalevsky and Küpffer, the development of the ascidian is similar to that of the amphioxus. This creature looks like a piece of jelly, but it is found to have a rudimentary nervous system, and something which is presumed to be a vertebral column, but which is a simple cartilaginous rod with a chord of nervous matter above it, as shown in the diagram, Fig. 7*, *a b*. This organism's 'place in nature' has hitherto been considered doubtful; but the Darwinian and evolutionary dogmas find it a useful means to leading from the Vertebrate to the Invertebrate sub-kingdom. So important is it considered by Häkel that he wants to place this jelly-like creature in a





FIGS. 7 and 7*.—AMPHIOXUS LANCEOLATUS (or Lancelet). The lower figure is diagrammatic, and shows the internal organs. *a*, *b*, so called vertebral column, the upper line showing the cylinder of nervous matter. *d*, The heart, and the dotted lines show the ramifications of the vascular system. *e*, Mouth, leading into the alimentary canal. *c*, Anus.

separate order. The next phase in human genealogy, according to Darwin, is the cartilaginous fishes, of which the sturgeon is typical. I give a drawing.

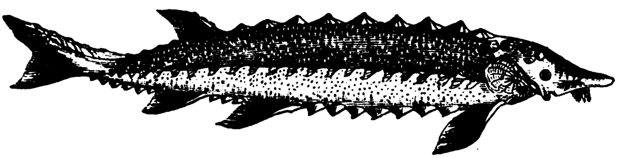


FIG. 8.—THE STURGEON. From a specimen taken at Oakley, Essex. (Drawn by G. Reed.)

Mark the vast changes in time which must have occurred before the amphioxus could have been evolved into the sturgeon. Still more does this remark apply to the next phase, for nothing can be more different than the sturgeon with its isinglass swim-bladder and the lepidosiren, an amphibian reptile, in which is found the first appearance of a lung.

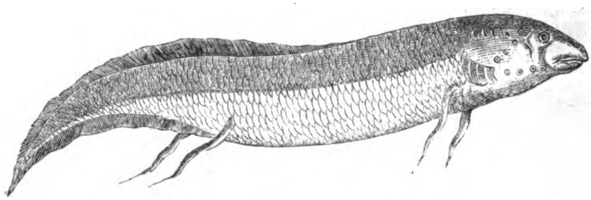


Fig. 9.—The Lepidosiren.

This remarkable creature is called amphibian, not because it can move about like a frog alike in water or on land, but owing to the fact that it has the power of remaining dormant, buried in *dry mud*, for six months, and, when the water is renewed, become active and lively again.

Mr. Darwin says it is not known by what actual means of ascent man came through fishes and amphibians. He quotes Huxley, however, that dinosaurians (extinct reptiles) have affinities with birds, and that the duck-billed platypus has affinities with both birds and reptiles; therefore he places the latter as an important link in our genealogy. Here it is. (Fig. 10.) From the platypus he traces us through an imaginary implacental mammal to the kangaroo. I ought rather to have said, that after reptiles there was evolved an

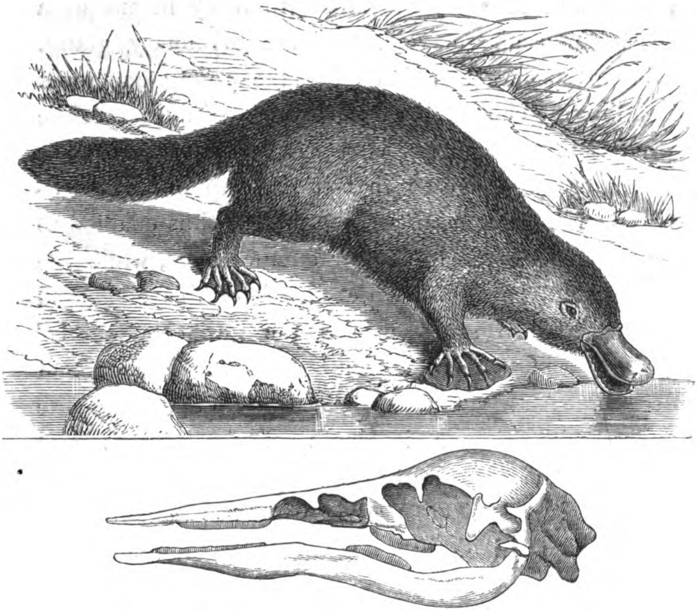


FIG. 10.—ORNITHORYNCHUS PARADOXUS. The duck-billed Platypus and its Skull.

implacental mammal, from which was descended both the newdmetic ornithorynchus and kangaroo (fig. 11).

But the anatomy of the kangaroo points out most serious objections to such evolution having been effected by means of natural selection.

Mr. St. G. Mivart has summarised the difficulties as follows :—' The young kangaroo is born in such an exceedingly imperfect and undeveloped condition that it is quite unable to suck. The mother therefore places the minute, blind, and naked young upon the nipple, and then injects milk into it by means of a special muscular envelope of the mammary gland. Did no special provision exist, the young one must infallibly be choked by the intrusion of milk into the windpipe. But there is a special provision. The larynx is so elongated that it rises up into the posterior end of the nasal passage, and is thus enabled to give free entrance to the air for the lungs, while the milk passes harmlessly on each side of this elongated larynx, and so safely attains the gullet behind it.' Can anything be more beautiful than this instance of design? And yet the whole cycle of organic life teems with similar instances of forethought and adaptation of structure to the purposes of existence.

Now, Mr. St. George Mivart has conclusively proved that this designed structure in the marsupials could not have been produced by 'natural selection.' If so, there is an end of Mr. Darwin's line of human development, or as he would call it, 'evolution;' for one good case against 'natural selection' strikes at the root of the hypothesis as a whole. Let us hear Mr. St. George Mivart in his own words:—

'Now, on the Darwinian hypothesis either all mammals descended from marsupial progenitors, or else the marsupials sprung from animals having, in most respects, the ordinary mammalian structure.

'On the first alternative how did "natural selection" remove this (at least perfectly innocent and harmless) structure in almost all other mammals; and, having done so, again reproduce it, in precisely those forms which alone require it, viz. the cetacea? That such a harmless structure *need not* be removed, any Darwinian must confess, since a structure exists in

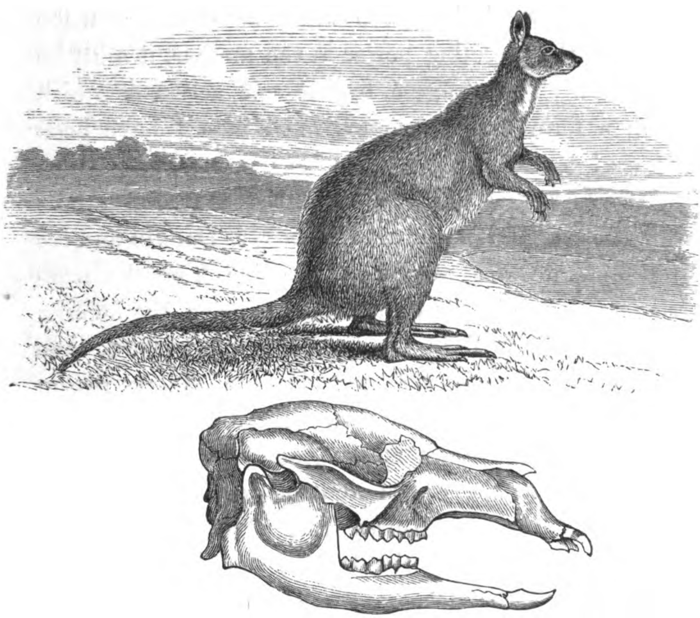


FIG. 11.—MACROPUS GIGANTEUS. The giant Kangaroo and its Skull.

both the crocodiles and gavials, which enables the former to breathe themselves while drowning the prey which they hold in their mouths. On Mr. Darwin's hypothesis, it could only have been developed where useful, therefore *not* in gavials (!), which feed on fish, but which retain, as we might expect, this, in them, superfluous but harmless formation.

'On the second alternative, how did the elongated larynx itself arise, seeing that if its development lagged behind that of the maternal structure, the young primeval kangaroo must be choked: while without the injecting power in the mother, it must be starved? The struggle, by the sole action of which such a form was developed, must indeed have been severe!'[1]

Leaving this difficulty and the thousand others which it suggests to be settled by Mr. Darwin and his followers, we are carried on the line from the marsupials to the lowest of the monkey tribe, the lemurs. Why this jump from the lowest to the highest, save one mammalian form? Mr. Darwin as one reason quotes Mr. Huxley, who has written that the group of Lemuridæ present many gradations, leading 'insensibly from the crown and summit of the animal creation, down to creatures from which there is but a step as it seems to the lowest, smallest, and least intelligent of the placental mammalia.' But then, the kangaroo, though the lowest of mammals, is not placental; but to get over this difficulty Mr. Darwin makes a large guess. He says the placental mammals were descended from the implacental—not from forms closely allied to the existing marsupials, 'but from their *early* progenitors.' So that after all, the kangaroo,

[1] Cf. *Genesis of Species*, pp. 42, 43.

LEMUR RUBER.
The Red Lemur and its Skull.

with its soft black eye, must go. He cannot in any way get directly into our ancestral tree.

Well, then, the lemurs, according to Darwin, are descended from those remote placental forms which were evolved from the remote implacental forms.

It looks very hazy, and ugly thoughts about skulls and limbs, and habits and modes of existence, crop up in the mind; but, as we are following Darwin's belief, not our own, we must take things as we find them, and therefore we now arrive at man's 'remote ancestor,' who must come in here if at all. I allude to the creature with cocked ears and tail, prehensile feet, both sexes covered with hair and having beards, and the male with huge canine teeth. From such a Darwinian creation were descended the lowest of the quadrumana, the lemurs (Plate I. fig. 12).

Thence we are told the Simiadæ were gradually evolved (Plate II. fig. 13), and the Simiadæ divided into two groups, the platyrhine or new world, and the catarhine or old world monkeys (Plate III. fig. 14).

Thence we pass to the anthropomorphous, or 'manlike ape' (Plate IV. fig. 15), and on through another imaginary creature, the so-called 'ape-like man,' to man himself (Plate IV. fig. 16).

It must be obvious to the most superficial observer what an enormous amount of mere guessing is made use of in such a pedigree! Still more clear is the fact that, even supposing the present state of science justified apparent plausibility in the indicated line, the science of to-morrow may send such guesses into a totally different direction. Let the impartial reader cast his eye for a moment over the table I have drawn up (frontispiece). He will see Mr. Darwin starts with guess No. 1; he then jumps over almost the whole class of invertebrate animals, to arrive at what he calls the first vertebrate animal—a form which has very little in common with the sub-kingdom it is placed in, but naturalists do not in fact know what to do with it. He then passes through cartilaginous fishes to guesses No. 2 and 3, as regards the amphibia and reptiles. Then an animal 'new to science,' the early progenitor of implacental mammals, forms guess 4. He cannot keep the platypus nor the kangaroo in the direct line, but he makes them minister to guess 5, in being the lines to the implacental forefather of lemurs, leaving out the great class of birds. He then jumps to the Lemuridæ at a bound, leaving all the principal families of mammals out of the line altogether.[1] Here he makes enormous guess No. 6, about man's early progenitor, who had cocked ears, a tail, prehensile feet, both sexes covered with hair and wearing beards.

From the lemurs he passes to the Simiadæ, and follows the catarhine group of monkeys, and has to make another huge guess, No. 7, in order to get into the line an imaginary creature he calls an 'ape-like man,' who leads him to the summit of existence—man. Nothing displays more the real ignorance of science,

[1] This is all copied from Häekel, as I have shown, *ante* p. 297–9.

Plate II. Fig. 13.

MYCETES URSINUS.
The Howler Monkey and its Skull.

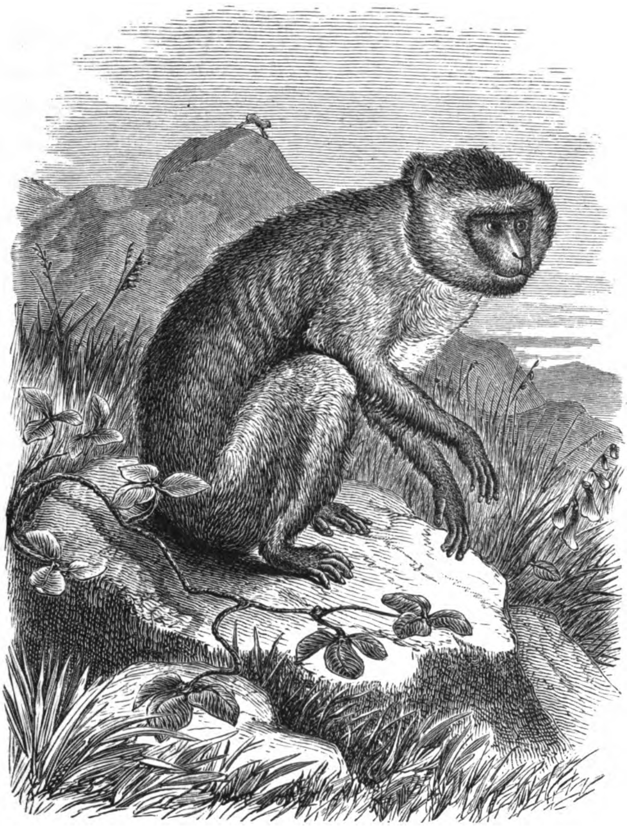
or the extreme baldness and improbabilities of Mr. Darwin's hypothesis than a table like this.

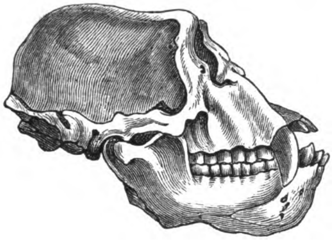
Every step down the line presents enormous difficulties both to the Darwinian and evolutionist, and it is only by blind adherence to an impossible belief, and by straining the limits of scientific discussion to its utmost, that even a plausible *primâ facie* case can be established to such a believer's own satisfaction.

Meanwhile the strain to which I have alluded is producing bad results. When grave philosophers assert that man could, by any possible stretch of imagination, be supposed to have been evolved and perfected by natural and sexual selection along Mr. Darwin's line, intelligent thinkers and men of education and high mental culture shake their heads and become disbelievers in natural science founded upon such a basis.

Mr. Darwin has, however, been quite outdone in speculation by the President of the British Association at the Edinburgh meeting. Sir W. Thomson is reported to have said that it was 'not unscientific' to believe that life might have come on to this earth in the form of moss or seeds of other plants, which might have filled it with the organic life it now contains. Sir W. Thomson declined to enter into arguments, or give any reasons for making a statement so extraordinary. It certainly looks like sensationalism, but then if so it is degrading both to science and the Society which affects to advance it. Considering that we have *no proof whatever* that any other planet except our own contains any or similar organic forms, it certainly does not look very *scientific* to believe it possible that they could have come through space riding on a meteor. It is well known also that meteoric stones, when they enter our atmosphere during their solar revolution, develop by friction, or, as Tyndall would say, convert some of their motion into heat, which either dissipates them in space, or is sufficient to destroy all organic elements.

When such statements are made from the presidential chair of one of the greatest scientific societies in the world, we may well enquire if modern natural science has any basis at all, or whether we have not become the deceived dupes of a system which has the most improbable and the most unprovable dogmas as the groundwork of its faith. Straining after the impossible, we have entered into an age of speculative philosophy which bids fair to destroy all that is grand and noble in our conceptions of Nature, and to lead us into the cold unimpassioned region of scepticism. To mock all sense of the beautiful with the derisive laugh of materialism—to check the aspirations of refined mental culture by the assumption of theories which are revolting to our better nature—to destroy upon unsound grounds the faith which every man of real nobility of intellect has, and always will have, in the ever-present mind and thought and hand of the Creator in Creation—to replace a final cause with a





MACACUS INUUS.
The Gibraltar Baboon and its Skull.

self-acting secondary law—to substitute chance for design, and to patch up a destroyed faith by attempting to reconcile truth and falsehood—when things have come to such a pass as this, the strongest mind might tremble for the fate of science itself, were it not confident in the ultimate triumph of the true.

CHAPTER XXV.

THE TELEOLOGICAL ARGUMENT.

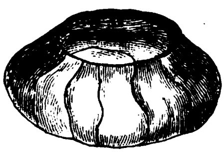
The Eye.—Its adaptation to different media.—Eye of Birds.—The Moveable Bony Orbit of Birds.—The Golden Eagle.—The Owl.—The Swan.—The Marsupium, a structure peculiar to the Eyes of Birds.—Its supposed use.—Professor Owen's View.—Impossibility of such a structure being formed by Natural Selection.—Least Action shown in the folding of the Marsupium.—Professor Haughton's Questions.

ALTHOUGH many instances have been already adduced of insuperable difficulties in the Darwinian hypothesis presented by the fore-ordained adaptation of structure to conditions of existence, I will devote a chapter or two to such instances taken at random from the organic world.

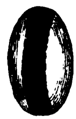
The eye is acknowledged by Mr. Darwin to be a difficulty almost insuperable. It is not only in itself an organ formed upon the most profound philosophical principles, but it is peculiarly adapted to the habits of each individual, and to the media in which they exist. Mr. Darwin may say, of course this must be so in my hypothesis, inasmuch as each variation of structure which benefits the animal is secured to it by my 'natural selection' and 'the survival of the fittest.' This argument has some plausibility when used to describe the improvements or deviations in the breeds of animals, but it loses all significance when applied to special organs of different species, genera, families, or classes. Thus, for instance, the eye of birds is supported by an apparatus consisting of bony plates, from thirteen to twenty in number, which, moving slightly upon each other, diminish and increase with the will of the bird its range of vision, by letting a larger or smaller number of rays pass through the crystalline lens to the retina. Now this lens varies in *form* in different birds. In the golden eagle it is developed in reference to the bony case, having an axis in proportion to diameter of $3\frac{8}{10}$ to $5\frac{7}{10}$,[1] allowing of course a variation in the axis of the lens proportionate to the movable bones in the case, and thus accommodating the eye to the difference in vision which is effected by the microscopist when he changes his object-glass. But this necessitates an extreme nicety of adjustment, and also a reasoning power which foreknows the modifications required by the eyes of each separate bird. If an optician makes an object-glass, he does so in reference to the objective—the lens. Instead of using a clumsy tube of brass, with a glass at one end and an orifice, larger or smaller, covered with glass at the other, the bird carries its objectives in its own head, and just as it wishes to enlarge or diminish the field of vision does it move the bones of the case in which its eye is enclosed.

[1] Cf. Yarrell's *British Birds*, 4th edition. Edited by Professor Newton, vol. i. p. 19.

And here is evidently a final effect produced by a final cause. According to Mr. Darwin's hypothesis, this addition to the eye of the bird is produced by variation and inheritance. But what an absurdity such a theory involves. We have a right to demand a *raison d'être.* Did the bird's eye vary *pari-passu* with its evolution from a lower form, and at the same time did the bony case begin to be evolved by a small speck of bony tissue here, and another small speck there, which caused the coming bird to be benefited,



CASE.



LENS.

FIGS. 17 & 18.—*Crystalline lens* of the Eye of Eagle, and the bony moveable eye-case of same.

and so to become the 'survivor of the fittest?' Or did the bird's eye become evolved first, and then by a sudden and chance variation did the bony case shoot into being?

The number of bones in this case in the eagle's eye is fifteen, and I copy from Yarrell the little figure which he has given of this structure, and also of the crystalline lens (Figs. 17 and 18).

If we take another bird's eye, that of the owl, for instance, we shall find a still more beautiful adaptation to circumstance. The owl feeds upon mice, which only come out of their holes at twilight. To catch mice at such a time, the eagle's eye would have been useless. It requires as much light as possible, and therefore it has a large *flat* eye, the axis of the anterior portion being twice as great as the posterior. This, allowing room for a greater proportion of aqueous fluid, and 'removing the lens away from the retina, causes a greater convergence of the rays of light, by which the nocturnal bird is enabled to discern the objects placed near it.'[1]

But now, what about the case of moveable bones? Why, in the owl, not being wanted for nice focal adjustments, it is made to subserve another most useful purpose. The plates, says Owen, in the owls 'extend from the cornea over the long anterior division of the eye to the posterior hemisphere, which they also contribute to form. *The figure of the eye is thus maintained, notwithstanding its want of sphericity.*'

What power produced this beautiful instance of compensatory adjustment of structure to function? A man must be indeed infatuated with his theory, who would maintain that it was done by 'natural selection,' or by any secondary law. We have here the supervision of the Master Builder, so beautifully elucidated by Agassiz and Haughton, as we shall see presently.

Again, the swan has to feed at the bottom of water. I will not be tempted to say anything about this bird's long neck, because I have a wholesome dread of stories

[1] Owen's *Anatomy of Vertebrates*, vol. ii. p. 136.

about giraffes' necks having been lengthened by reaching up to trees for their food! But suppose the swan has got his long neck by the survival of the fittest long neck, how was its eye modified? The lens here has an axis of 3 to a diameter of $3\frac{8}{10}$, a form which, again, an oculist will tell you is the best fitted to receive the refracted rays of light by which the bird can most easily distinguish its food at the bottom of the water!

What oculist altered the swan's eye to see in water, that of the owl to see by twilight, or of the eagle to see long or short distances from a great or less height in the air? It is idle to say, let the authority be ever so great and its reputation ever so high, that it is *conceivable* that at a certain time a variation occurred, which *might* have given advantage to the bird, which *might* have survived in the struggle for existence, and so *might* have allowed, by 'correlation' or 'use,' the lens to alter its shape, and accommodate itself to altered circumstances!

I have not to deal with a question which can be treated thus summarily. The structures and their uses are clear enough. The cause and effect are clear enough. The adaptation of structure to circumstances of existence is beyond all cavil. Why then am I to be deprived of the only solution which sound logic affords me? These organs have been created and designed by a superior Intelligence, the first and final Cause of the world's life and being.

Before leaving the eyes of birds, I will allude to a structure peculiar to them, viz., what is known as the marsupium. Generally speaking, among the higher animals the optic nerve enters the globe of the eye posteriorly, and immediately expands into the retina. But in birds the optic nerve occurs as a narrow white streak extending through the posterior chamber, and furnishing nerves to form the retina from its extremities and sides. Extending from the point where the optic nerve enters the globe of the eye, through the vitreous humour, in some instances as far as the back of the lens, is the marsupium, a plicated membrane, folded into the smallest possible space. It is black, and almost entirely composed of blood-vessels, and when unfolded it is found to occupy a very considerable surface. Now this marsupium differs in situation in different birds. In some it goes through the vitreous humour to the back of the lens. In others it only goes half way. It differs also in form, being in some broader than long, and in others the contrary. The plicæ also differ in number, from four in the cassowary to twenty-eight in the fieldfare.

Now what is the use of this singular and unique structure in the eye of birds? No one will deny that it must have a peculiar and an important function. But no man can tell us what that function is! Some have supposed that it was intended to absorb the intense rays of light to which birds are exposed; others that it is a gland of the vitreous humour, required to renew fluids to the eye. Professor Owen believes that it may act as an erectile organ, occupying, according to circumstances, greater or less space, and so acting upon the position of the lens; and in support he quotes the apteryx, which, being a nocturnal bird, would have no need of such an organ, and it has none![1]

Well, how would such a structure as this be formed according to Mr. Darwin's theory? Existing only in birds, it must have been added to the interior of the eye after the bird had become evolved; but as man, with all his knowledge, cannot point out its use even, surely the Power that placed it there must have been supreme, and it must have been a Power which superintended and guided, not a force called into action by the secondary laws of matter, or the result of variation and natural selection.

Mark also the principle of 'least action' brought into play. Why is the marsupium folded into plicæ? Clearly that a large surface may occupy as small a space as the posterior chamber, filled with its vitreous humour, could afford to give it. Who or what folded up the marsupium with this object? Surely not blind force, nor accidental variation, nor the fittest who survived, nor sexual nor natural selection!

Professor Haughton asks similar questions in reference to the principle of least action, as shown in the arrangement of human muscles. 'Is it by intelligence of the planet that it moves in its orbit? Does the

[1] *Op. cit.* vol. ii. p. 140.

light travel in its path by its intelligence? By what force, or by what intelligence, do the limbs of animals describe their proper path? Who places the socket of each joint in the exact position (which can be calculated with unerring precision by mathematics), which enables the muscle to perform its allotted task with the least amount of trouble to itself? It is not by their intelligence, by their instinct; it is not the instinct of the planet or of the bee that guides them in their path. There is instinct, there is knowledge, there is foresight, there is calculation; it is the knowledge, the foresight, the wisdom, and the calculation of the Great Architect and Geometrician of the Universe.'[1]

[1] Lecture on *Least Action in Nature*, by Professor Haughton, p. 14.

CHAPTER XXVI.

THE TELEOLOGICAL ARGUMENT CONTINUED.

The Human Ear.—Its elaborate beauty.—Structures final.—Variation as a Cause of such Organism ridiculous and absurd.—Diagram of Ear.—Description of the Course of a Wave of Sound, and concurrent description of the use of each part of the apparatus.—Sublime Contemplations produced by reflecting upon these exquisite series of structures.—Fibres of Corti.—Professor Huxley's lucid description of their use.—Proofs of Design and 'Least Action' shown under eleven different heads.—Mr. St. George Mivart's opinion against the Possibility of Natural Selection playing any part here. —Reviewer of Darwin in 'Edinburgh' for July 1871.—Mr. Holden, the Anatomist, quoted.

I WILL take my next illustration from the human ear.

The organ of hearing in man is one of the most complex, and yet most beautiful, structures in the human body. It would take a small volume to describe and comment upon the wonderful mechanism by which we are able to appreciate sound, under the infinite variety of phases in which it is presented to us. From the feeble whisper of sickness or old age to the grand chorus of 4,000 voices raised in one harmonious strain of praise and thanksgiving, all the thousands of variations of sound are provided for with reasoning forethought. The song of a Jenny Lind or a Mario, the grand music of a Thalberg, a Lizt, or a Paganini, could never have been appreciated had not the human ear been specially adapted for each and every *kind* as well as *degree* of sound.

And the structures upon which this depends are final. Our reason can suggest no improvement in the grand complex harmonious whole which constitutes the hearing apparatus in man. The thought of variation, as a *causa vera* of such a combination of structures, appears to the contemplative mind as ridiculous and absurd as that of a change in the order and movements of the sidereal system. The sensitive mind shrinks from the bare possibility of human wisdom being able to suggest how a fore-ordained system of beautiful adaptations could have arisen by 'variation' or 'natural selection.'

In order that my remarks may be followed, I append a diagram and drawing of the ear (Figs. 19 and 20). I intend my description for the general, not the scientific reader. Well, then, let the line marked A B be the passage of a wave of sound, passing through the external ear, which Mr. Darwin says is useless in man, but which is a part of the whole perfect structure, and concentrates the waves of sound before they enter the passage (A), and pass down to the tympanum or drum membrane (B), against which they strike. Now this membrane is impervious, and divides the external from the middle ear. Mark that it is placed at an angle of 45°. Here is the first striking adaptation; for, looking beyond it, will be observed four little bones, the first one of which is attached to the inner portion of the tympanum membrane; and as the four bones have an important office to perform, it is obvious at a glance that the oblique position of the membrane has a reference to its attachment to the first bone, the *malleus*, or mallet, as it is called. Its obliquity also ensures that

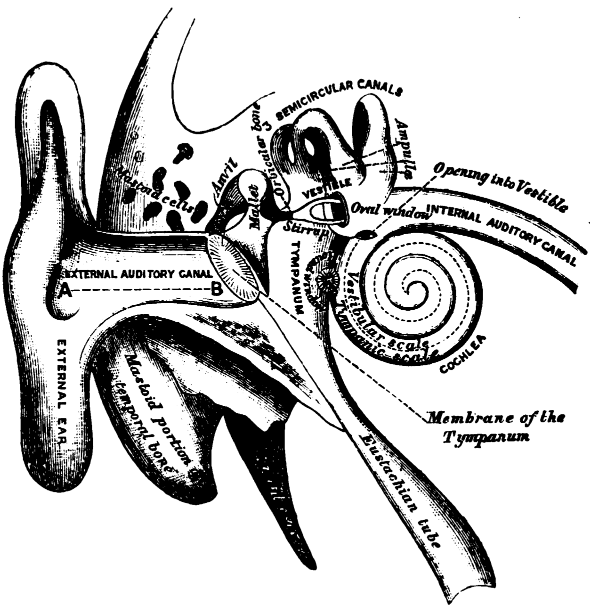


Fig. 19.—Diagram of Human Ear.

the full extent of its surface should be exposed to the waves of sound.

Now take notice that there is a stirrup-shaped bone attached to the middle bone, not directly—*that* would spoil the mechanism—but by means of a very small 'orbicular bone' placed like a joint between them. Then the base of the stirrup is attached to another membrane, which covers the opening into the internal ear, the basis of which is marked '*vestible*' in the diagram, and in the interior of this the auditory nerve is spread out.

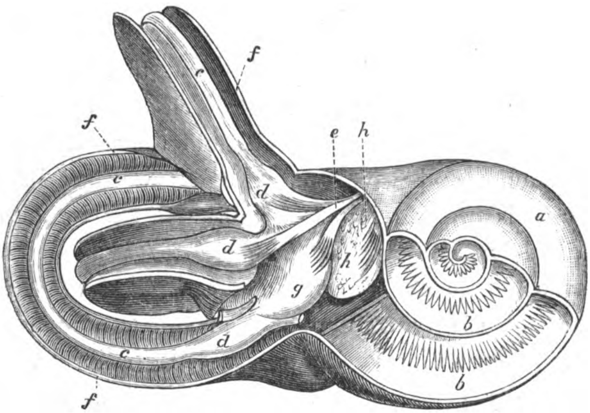


FIG. 20.—*Section of Human Internal Ear.* *a*, Cochlea. *b b*, Lamina spiralis. *c c c*, The membranous portion of the semicircular canals containing the endolymph, and terminating in the ampullæ *d d d*, which are seen receiving the branches of the auditory nerve *e*. *f f f*, the bony cavity of the semicircular canals containing the perilymph. *g*, the utricle. *h*, the saccule, magnified. After Valentin.

Well, then, it will be remarked that between the bone attached to the membrane of the tympanum and that which covers the *fenestra ovalis*, or oval window, as it is termed, there is a fourth bone, the shape somewhat of a blacksmith's anvil, and hence called *incus*.

Now attached to the membrane of the tympanum internally are two exquisite little muscles, one of which extends and is joined to the minute orbicular bone between the stirrup and the anvil, and the other to the *mallet*. Remember that the use of these little muscles is to restrict or modify the vibration caused on the tympanic membrane by the wave of sound, which we are about presently to follow. Before doing so, however, observe that in the middle ear there are some irregular hollows, called '*mastoid cells*.' These give increased room for the air which fills the cavity of the tympanum, and which, after being warmed in the mouth, is brought into it from the throat by a tube marked in the diagram '*Eustachian tube*.' This air in the middle ear presses and keeps tight the membrane of the tympanum, and in this condition our wave of sound strikes it, and causes it to vibrate. So beautifully constructed is this mechanism, that the minutest vibration of the membrane of the tympanum causes the four little bones to vibrate also, and in doing so they partially rotate upon their axis, and so increase the intensity of the vibration, and convey it to the membrane covering the *fenestra ovalis* (oval window), which is in direct communication with the internal ear. The vibrations are also more or less communicated to the air in the middle ear, and so act upon the membrane covering another opening into the internal ear, marked *fenestra rotunda* (round window) on the diagram. Finally, as far as vibrations are concerned, they may be communicated to the internal ear directly through the bones of the skull, as anyone may prove by placing his watch between his teeth, when he will hear it tick much louder than he did before.

Before proceeding let us dwell for a moment upon the exquisite apparatus I have, I trust, made clear to the reader. It is a perfect whole. Take away any part of it, and it would be an imperfect production. Take away the air, and deafness would result. Forethought and reason have provided for this by placing the air-tube out of harm's way, except from the colds or ills which flesh is heir to. Alter the shape of any one of that line of bones, or their mode of attachment to each other, and to the membranes of the tympanum and the vestible, and our sense of hearing would be destroyed, as it is too frequently by disease or accident.

But now let us look at the rest of the works to which those described are merely accessory.

The inner ear, as shown by the diagram, consists of—

Three semicircular canals;

The vestible;

The cochlea, spirally turned upon itself;

The posterior opening called *meatus* (internal auditory canal), through which passes from the brain into the ear the auditory nerve. These parts are marked on the diagram.

For my purpose a brief description of these exquisite structures will be sufficient. Were I writing for an anatomical student it would be necessary to be much more minute.

The semicircular canals may be described as hollow tubes of bone, containing similar membranous tubes within, both of which dilate at one end, just before they join the *vestible,* into little swellings or *ampullæ.* The membranous tubes are separated from the bony tubes by clear crystal water, called the *perilymph,* while they themselves contain a similar fluid called the *endolymph.*

The *vestible,* as shown in the diagram, is placed between the ends of the semicircular canals which open into it, and the cochlea, *one half* of which also opens into it. It is a bony cavity of an oval form, measuring about $\frac{4}{16} \times \frac{3}{16}$ inch. It contains within it two bladders, the *saccule* and the *utricle,* which communicate only with the membranaceous tubes of the semicircular canals, and thus prevent the endolymph which they contain from being mingled with the perilymph which supports them. These two bladders are termed the membranous labyrinth, and each of them is connected with a portion of the bony part of the vestible which is perforated by holes only visible with the microscope, and on the internal aspect of these cribriform structures are found small calcareous crystallised particles, termed 'octonia,' the use of which I will allude to presently.

The *cochlea* (Figs. 19 and 20) is a conical tube coiled $2\frac{1}{2}$ times upon itself, having the figure of a cornu ammonis. This coiled tube is divided by a spiral partition into two parts, which only communicate at the apex. Below, one of these channels opens into the vestible (see diagram), the other into the cavity of the tympanum, and are called accordingly tympanic scale and vestibular scale. But the partition which divides the tube of the cochlea is formed of bone, of cartilage, and of membrane. The student who wishes to examine this wonderful structure will find half a day's good work well spent in doing so. It is called the *lamina spiralis*, and I shall have occasion to refer to it presently.

The *internal auditory canal* (diagram) is the channel by which the auditory nerve passes into the internal ear. At the bottom of the meatus are two compartments, divided by a crest of bone. The first of these compartments has two openings; one, termed the aqueduct of Fallopius, transmits the 'facial' nerve—up to this point the nerves are in partnership; the other compartment must be examined by a lens, and it will be found to be perforated by minute holes through which the auditory nerve sends minute filaments which spread out on the membranous labyrinth, and as far up the semicircular canals as the ampullæ before mentioned.[1] In the other compartment, which is larger, we find a vast number of foramina, arranged in double rows and in a spiral form. Now, if each of these foramina is examined with a lens, it will be found to

[1] See Fig. 20.

be a pit or depression, pierced with from three to seven minute holes, through which the branches of the cochlear nerves are sent into the interior of the cochlea!

The reader will, I hope, master these details; they are much compressed, but I think they are intelligible, and if so, few people can read them without a glow of wonder and admiration. But now let us follow my wave of sound, which we left knocking at the windows oval and round in the cavity of the tympanum.

First, however, let the reader observe that the semicircular canals are formed and placed upon the principles of geometry. 'They are so situated that they correspond to the three dimensions of a cube, its length, breadth, and depth, and that every sound arriving in one of these three directions will always strike one canal at right angles to its axis, and another in its length. The position of these canals is likewise such that the corresponding canals of opposite sides cannot be parallel, and that therefore any sound which strikes the head in any given direction affects the semicircular canal of one side much more than the corresponding one of the opposite side, whereby it may be determined whether the sound coming in a straight line (from west to east, for example) has really moved from west to east or from east to west.'[1] Also observe

[1] *Autenrieth und Kerner, in Reil und Autenrieth's Archiv für die Physiologie*, B. ix., 1809, and quoted by Dr. Todd in the *Cyclop. Anat. and Physiology*, Art 'Hearing.'

the *form* of the cochlea, so admirably adapted to give large surface in a small compass. And lastly, let it be remembered that all these important structures are contained in the centre of the *hardest bone in the body.*

Well, then, we left our wave of sound knocking against the oval and round windows leading into the vestible and cochlea. By striking against the oval window, the water inside the membranous labyrinth[1] the endolymph is also made to vibrate in small wavelets. These wavelets strike the long epithelial hair-like terminations of the auditory nerve in the *ampullæ*,[2] and so sound is rendered appreciable to the sense.

In the vestible, Professor Huxley believes that the small crystals of lime termed octonia have the same purpose as the epithelial terminations of the nerves in the ampullæ. The vibrations communicated to the air in the tympanum also strike the round window, and communicate with the perilymph in the tympanitic division of the cochlea; this in turn acts upon the endolymph, and through it upon the wonderful structure in the *lamina spiralis*, termed the fibres of Corti, by which the waves are converted into impulses which cause the sense of hearing in the cochlea![3]

But the two senses, if I may use the expression, are different. That produced by striking the nerves in the ampullæ tends to distinguish intensity or *quantity* of sound; that produced by the fibres of Corti in the

[1] See Fig. 20. [2] Fig. 20, *d d d*. [3] Fig. 21.

cochlea has reference to the discrimination of *quality* of sound. Such at least are the opinions of some of our best physiologists; but the subject is difficult to study, and we infer rather than state positively that such is the case.

The use of this beautiful structure, the fibres of Corti of which Fig. 21 is a magnified section, will be

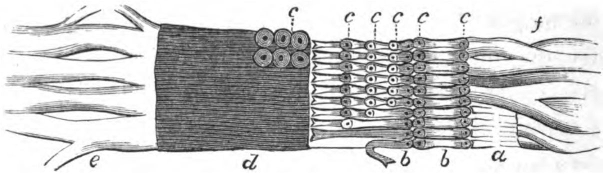


FIG. 21.—Part of the LAMINA SPIRALIS of the internal ear, magnified to show the fibres of Corti. *a*, first series of fibres. *b*, second series of fibres, one thrown back. *c*, epithelial cells. *d*, zona pectinati. *e*, periosteum by which the lamina spiralis is attached, with spaces between the bundles. *f*, cylindrical elevations of the *habena sulcata*, after Corti.

better understood by the following extract from Professor Huxley's 'Elements of Physiology,' p. 218:—

'There is every reason to believe that the excitement of any single filament of the cochlear nerve gives rise in the mind to a distinct musical impression, and that every fraction of a tone which a well-trained ear is capable of distinguishing is represented by its separate nerve-fibre. Thus, the *lamina spiralis* resembles a key-board in function as well as in appearance, the fibres of Corti being the keys, and the ends of the nerves representing the strings which the keys strike. If it were possible to irritate each of these nerve-fibres experimentally, we should be able to produce any musical tone at will in the sensorium of the person experimented upon, just as any note on a piano is produced by striking the appropriate key.

'A tuning-fork may be set vibrating if its own particular note, or one harmonic with it, be sounded in its neighbourhood. In other words, it will vibrate under the influence of a particular set of vibrations, and no others. If the vibrating ends of the tuning-fork were so arranged as to impinge upon a nerve, their repeated minute blows would at once excite this nerve.

'Suppose that of a set of tuning-forks, tuned to every note and distinguishable fraction of a note in the scale, one were thus connected with the end of every fibre of the cochlear nerve; then any vibration communicated to the perilymph would affect the tuning-fork which could vibrate with it, while the rest would be absolutely or relatively indifferent to that vibration. In other words, the vibration would give rise to the sensation of one particular tone and no other, and every musical interval would be represented by a distinct impression on the sensorium.

'It is believed that the fibres of Corti are competent to perform the function of such tuning-forks, that each of them is set vibrating to its full strength by a particular kind of wave sent through the perilymph, and by no other, and that each affects a particular fibre of the cochlear nerve only.'

Now let us briefly sum up the teleological facts which are displayed in this wonderful and exquisitely beautiful but complex apparatus, the human ear.

1. We have the general conception and the peculiar hard bony structure, which is so well adapted to convey sound and at the same time to protect the organs.

2. We have the peculiar medium made use of in the middle ear—*warm* atmospheric air, which is a chemical compound, final and unalterable in its nature under any circumstances whatever. And we have this air adapted to the pressure which obtains on the surface of the earth. On the tops of mountains, as pointed out by Saussure, a gun when fired only sounds as loud as a pistol below, owing to the rarification of the atmosphere. We read also that one of our arctic navigators sustained a conversation with another person at the distance of a mile and a quarter.

3. We have the medium of atmospheric air changed for that of clear pure water (perilymph) in the inner chambers, not only to conduct the waves of sound, but to allow the extremities of the soft nerves to bathe in the same (endolymph), and thus receive more sensitively the vibrations of sound. This fluid is identical in composition with water, which is a final and unalterable chemical compound.

4. We have the final law of the lever brought into

play by the vibrations communicated from the membrane of the tympanum to the malleus, and in the small tensor muscles.

5. We have the final law of the pendulum shown by the mode in which the small bones are made to swing upon an axis formed by their own short processes.

6. We have the vital and final law of elasticity shown in the behaviour of the membranes closing the tympanum, vestible, and cochlea; and the adaptation of tight membrane to convey sound from air to water, and also to ensure a *continuous* vibration through the labyrinth. Sir Charles Bell justly remarks, 'the provision is beautiful.'

7. We have the final law of the screw shown in the formation of the helix-like cochlea.

8. We have the geometrical cube made use of in the semicircular canals, which are so disposed as to be of the greatest possible amount of use with the greatest economy of space—thus illustrating also the law of 'least action.'

9. We have the beautiful division of the auditory nerve passing through minute orifices into the membranous labyrinth, forming there a vast surface of free hair-like processes bathing in fluid, and ready to receive and convey to the sensorium the vibrations caused by the waves of sound.

10. We have a similar and still more exquisite division and disposition of the nerve which supplies the scala vestibuli, or vestibular side of the *lamina spiralis*

of the cochlea— forming there vast numbers of minute processes, shaped and acting like the keys of a piano, each obedient to its own peculiar inflection of sound, and producing in the brain all the grand and exquisite impressions of music in their simplest as well as most complex phases.

11. We have all these final laws acting in concert to produce a certain and final end, preconceived, preordained, and perfected by Infinite Wisdom.

It would be useless to talk about such structures being formed or changed or altered by the same laws of variation by which a pigeon-fancier can produce a 'bird to order' by crossing one variety with another. The mind revolts, and rejects at once the thought that the organs I have described could have resulted from a chance variation, inheritance, the struggle for existence, or natural or sexual selection.

Mr. St. George Mivart has well pointed out the impossibility of this:—

'These complex arrangements of parts could not have been evolved by "natural selection," i.e. by minute accidental variation, except by the action of such through a vast period of time; nevertheless, it was fully evolved at the time of the deposition of the upper Silurian rocks.'[1]

By 'complex parts,' Mr. St. G. Mivart does not mean parts as exhibited in the human ear. He is alluding to the simplest vertebrate type of the organ—

[1] *Genesis of Species*, p. 74.

'two membranous sacs containing calcareous particles' —and he carries on the argument to the Cephalopoda, between whom and the Vertebrata no genetic link has ever been discerned, but in whom the above kind of auditory apparatus exists.

The able reviewer of Darwin's 'Descent of Man' in the 'Edinburgh' for July 1871 remarks upon this subject:—

'The formation of the ear and eye in man and lower animals also affords a crushing argument against Mr. Darwin. . . . These complex and simultaneous co-ordinations could not have been produced by small beginnings, since they are useless until the requisite junctions are effected. In this case, without definite purpose it is hard to believe how the simultaneous changes in one direction could be effected, and it is incredible that they should have been brought about by a combination of chances.'

It is a favourite doctrine with Mr. Darwin that variations which take place in a living body are inherited and occur at a similar period in the future life of the individual. Now the series of small bones which I have just described are not only fully developed at birth in the human subject, *but they do not increase in size afterwards.* Mr. Holden, the anatomist, mentions a case ('Anatomy,' p. 245) in which 'I have before me the tympanic bones of an infant at birth, and those of a man who was seven feet high, and there is not much difference between them in point of size.'

If Mr. Darwin's doctrine were true, how is it possible that these bones could have been developed by 'use' and 'correlation,' 'variation' and the 'survival of the fittest?'

When Mr. Darwin comes upon a case like this, he generally admits with true scientific candour that it militates against his doctrine. But the instance above related does more than this. *It utterly destroys it.* All the organs of the internal ear are hewn as it were out of the solid rock, and it is a beautiful instance of forethought and adaptation that they should be formed in the infant of such a size as to require no alteration in the future growth of the body.

CHAPTER XXVII.

THE TELEOLOGICAL ARGUMENT CONTINUED.

M. Agassiz.—Structure of Animal Life.—Definite Laws of Distribution of Animals.—Always Order, which shows 'Consecutive thought. It is something which the Architect retains to Himself only while he is superintending the work.'—Echinodermata. Proofs taken from Order of Succession in Time and Order of Gradation in Structure.—Coïncidence of Result produced by different *Methods* or different *Ideas*.—Development of Echinoderms.—Crinoids.—The three different Ideas of Order in which Animals first appear on Earth.—Similarity of Complication in Structure of Lowest to Highest, and Order of Growth.—The Radiates.—Potentiality of Original Speck of Matter according to Evolutionists considered, and its utter Incompatibility with Facts of Creation shown.—Our ignorance of the mode by which Species were created.—The Holothuridæ.—Sea Urchins.—Star Fish.

THE next illustrations of Design I shall take from the great American comparative anatomist, M. Agassiz, and I will make no apology for quoting freely from his works, as they are not much read in this country, and we have seen that his views as to Darwinism have been misrepresented.

In his work entitled 'Structure of Animal Life,' p. 95, we find the following:—

'At all times the world has been inhabited by as great a diversity of animals as exists now, and at each period they have been different from those of every other period. Thus, in the lowest of all geological fossiliferous strata, the Taconic, we find remains of animals belonging to all the four great kingdoms of nature, including the Vertebrata! and what is still more remarkable, we have representations of all the *classes* of the first two kingdoms, and with the exception of insects—which, however, may yet turn up—of the third also.' 'Animals are distributed on the surface of the globe according to definite laws, and with remarkable regularity. There is no disorder in their distribution, only it requires long study before we can grasp their diversity to such an extent as to be able to understand how they are combined on the surface of the globe.'

'*Now in the order of succession* we find something quite similar. . . . And not only is there order in this succession, but there is an order *which shows at all times consecutive thought—which at the outset perceives the end.* This is something *which is never put by mind into machinery; it is something that the architect retains to himself only while he is superintending the work.* In the combinations which are observable among the representatives of the earlier period we can discover that relation to one another which at the very beginning implies that the end is perceived.'[1]

In proof of the opinion thus expressed, Agassiz takes the class Echinodermata :—

'In the class of Echinoderms, we find living in the

[1] *Op. cit.* p. 97-99.

present seas five typical forms (Figs. 22, 23, 24, 25, and 26). Fig. 22 has only one living species, and this is found in the West Indies, about Porto Rico, and is called Pentacrinus.

These figures will be recognised by every seaside rambler as 'five-fingers,' 'starfish,' 'sea-urchins,' 'sea-anemones,' and the sea-cucumbers (Fig. 26), the most complicated in structure of the series.[1]

Now if we go to the 'stone book,' and search its pages, we shall find that the lowest strata at 'any part of Western New York' contain an innumerable quantity of echinoderms, but they are all of one kind, sea-lilies (Fig. 22). They are all crinoids, and at one place there are as many different species of these crinoids as there are of all other echinoderms along the enormous coast of the United States.

Following the strata *upwards,* through the limestone of Pennsylvania to the carboniferous rocks, we find abundance of starfishes, but no crinoids; a little higher we find genuine starfishes, and still higher genuine sea-urchins, but not a single specimen of Fig. 26. The highest organised echinoderms all live in the present time. Now mark the important fact established by these illustrations.

The order in which the echinoderms have come into being in past ages is exactly the same order or series 'to that which we observe in the gradation of the structure of the present living species of the same

[1] *Op. cit.* p. 100.

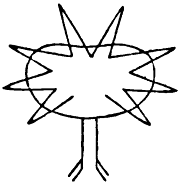


Fig 22

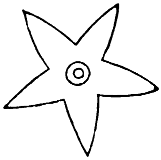


Fig 23

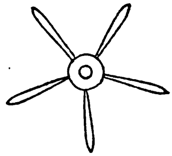


Fig 24

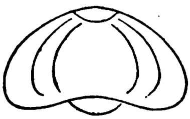


Fig 25

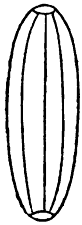


Fig 26

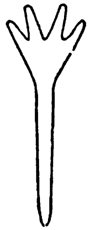


Fig 27

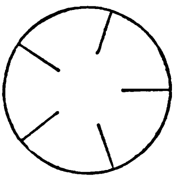


Fig 28

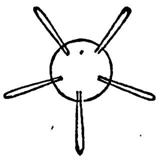


Fig 29

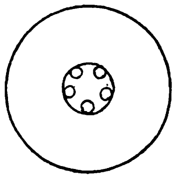


Fig 30

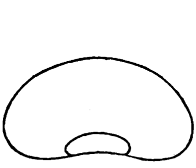


Fig 31

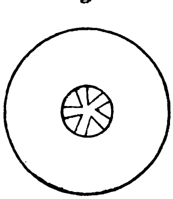


Fig 32

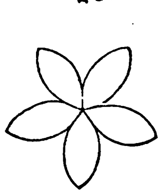


Fig 33

animals. We have two series which coincide in their result; one an order of succession in time, and the other an order of gradation in structure. *It is a coincidence of result obtained by different methods or different ideas.*'[1]

The author then illustrates the development of starfishes. When forming within the egg, the little being is attached to a 'stem or prong, with branches above forming a kind of cup (Fig. 27). It resembles those echinoderms first born on the surface of the earth, the crinoids, the type of which has become extinct, with one exception (Fig. 22), and just as we find geologically that after a certain period starfishes with stems no longer exist, so we find this embryonic starfish casts off its stem, becomes free, and assumes the form of its parent!

And then Agassiz asks, 'Now, what is there to bring about this coincidence if it is not the mind that has devised the order in which animals should appear on earth—the mind that has assigned to the lowest in structure the same degree of complication that was given to the oldest in the order of time—the mind that has established the order of growth of the young animal after the same pattern and upon the same idea that is presented in the order of time and in the gradation of structure?'

'We have here then three different ideas in *no way necessarily connected with one another.* 1. The plan upon which animals shall vary in their structure in the

[1] *Op. cit.* p. 102.

course of time. 2. The order of gradation of structure of living beings. 3. The order of the growth of the young animal from the egg. And yet in their results these three ideas are the same. Here then we have the work of mind, but not of a mind which acts by necessity, but with the freedom of Omnipotence. We have it here directly, and we can demonstrate it the more fully as we trace the facts thus presented more in detail.'[1] Passing over similar evidence adduced by M. Agassiz from the Crustacea, which are however well worth reading by the thoughtful student, let us continue awhile with the radiates and see how from them this great philosopher draws conclusive and unanswerable 'EVIDENCE OF AN INTELLIGENT AND CONSTANTLY CREATIVE MIND IN THE PLANS AND VARIATIONS OF STRUCTURE, and I keep to the radiate animals, because nowhere,' 'without the deeper study of anatomy, is the evidence of plan more plain.'

Well then, let us take as the basis of the radiate structure the sphere in which all the points are equally distant from the centre. This sphere is not a mathematical sphere but an organic and living sphere, in which the outer structure does not bear relation to a central point but to an axis which extends between two essentially different poles.

Now Agassiz takes the question of radiation, or the formation of animals upon this radiate plan, as a *mathematical question*, and he refers to a celebrated

[1] *Op. cit.* p. 102-3.

mathematician the following question: 'How to execute with the elements given—with a vertical axis around which are arranged parts of equal value—all the possible variations involved in that plan without introducing *new* elements?'

The answer readily given was this: '*That the simplest way would be to represent the whole sphere as a series of wedges placed side by side with one another.*'

Agassiz points out the melon, whose ribs on the outside will give the idea of wedges combining to form a spheroidal body. The orange gives the same idea; it is formed of a number of spherical wedges, 'the edges of which correspond to the axis, the spherical surfaces of which are segments of a sphere, and the sides of which are the surfaces dividing those segments one from another.'

In executing any structure upon the idea of radiation, it is obvious a variety could be at once effected by changing the number of wedges and perhaps their relative dimensions—by changing the thickness of the wedge near the equator—by having each wedge hollow and surrounded by thin walls—by making the walls thicker and reducing their cavities—by isolating the surrounding elements, freeing the cavities in the interior, and giving them distinct walls—this would so complicate the structure as to produce independent orders, and these are the mathematical combinations which mathematicians present as the various possibilities of these structural elements.

Now applying these rules or laws to three of the classes of radiates, they are found to differ from one another 'in exactly the manner in which a mathematician conceives that these elements may be combined with one another.'

In Polyps we have a cavity divided by radiating partitions (Fig. 24). In Acalephs we have tubes leading from the central cavity surrounded by a solid gelatinous substance (Fig. 29). In Echinoderms we have an outer solid wall, 'and these tubes transformed into independent organs, which wend their course in various ways in the interior, forming a complicated structure. So we have a plan in the construction of these animals similar to that which a mathematician would conceive. *The mathematician to whom I appealed for the solution of the problem was entirely ignorant of natural history, and could not, therefore, have obtained his knowledge from the animal structures; and yet he at once devised these three as the only essential plans which could be framed upon the idea of a radiated structure around a vertical axis.*' [1]

Now there is no mode of explaining the remarkable facts stated in the above passage, and which are equally applicable, though in an infinitely more complex manner, throughout all organised nature, except by the operation of a designing and all powerful mind. The great argument of the transmutationists in regard to the primitive speck of organic matter, from which they

[1] *Op. cit.* p. 115.

imagine that all living things on the face of the earth have been evolved by physical laws or their correlatives, is that it is equally honouring to the Creator and equally illustrative of His power and design to believe that He imbued that original speck with the powers of evolution, adaptation, variability, and transformation in the beginning; that the secondary laws by which all this is done were pre-destined and pre-ordained when the speck was created, and therefore they anathematise special creation, and become disciples of one of the wildest and most improbable theories ever advanced by scientific men. That the PLAN of creation was laid down originally by the Creator there can be no doubt. As Agassiz has shown, the skeleton of the fish was created with special reference to the ultimate structure of man himself. All we read about miracles being necessary for every variety is only one mode of trying to make your opponent's argument ridiculous. As to the method, the actual means by which species are created, we know nothing. But we do know that it is upon a uniform plan, guided in every step by an intelligent reasoning Being, and not by blind physical force or the chance shot of an uncertain 'struggle for existence.'

Let us further examine the admirable remarks of Agassiz. Having shown what he terms the 'freedom and richness' evident in the execution of the plan as represented in nature, illustrating the same by some excellent diagrams, he goes on to show that there are other problems of still greater interest when we study the radiate animals in greater detail—which details '*make it perfectly evident* that, when we analyse these structures, we disclose the mental operations of the Creator at every step.'

For this purpose he again takes the class Echinodermata, which exhibit three very marked variations of form.

1. The Holothuridæ, or sea-cucumbers (Fig. 26).

2. The sea-urchins, which have a more spherical form (Fig. 25).

3. The star-fish which has a star-like form (Fig. 23).

Then he offers to us the following problem: 'With the same structural elements to build a cylindrical, a spherical, and a star-shaped body—ask an architect to build with the same number of pieces, connected in the same way, a circular tower, an arched dome, and a pentagonal edifice! It will be a problem not easy to solve, especially if there is required the further condition that each structure shall be closed at the two ends.'

But when the structure of the animal is examined, the problem becomes quite simple.

Here are three figures of a sea-urchin in different positions (Figs. 30, 31, 32). Below there is the opening of the mouth armed with five jaws. Above there are a number of little plates, five of which are larger than the rest, each pierced with a hole. I will give the rest in Agassiz's own language, which is too precise to curtail:—

'Then the interior is occupied by a number of very small plates. Now each one of these small plates on the upper side corresponds to an interval between the two jaws on the lower side. From the centre extend five rows to the periphery, both in the upper and lower parts. These rows are built of a number of small plates, all of which are perforated with holes, and through these holes proceed tubes, by which the animal moves. The wider intervals between them are occupied by broader and therefore fewer plates.

'What are all these parts? The little plates at the summit are occupied by eyes; we have therefore five eyes. The broad plates which cover the surface of the sea-urchin contain the soft parts, which come out through the rows, and by which the animal is enabled to move.

'With these few very simple materials how shall we build a star-fish? Let us see how the star-fish is constructed. Seen from above it presents a network of very minute plates, and there is no alternation of larger plates at all. They extend all over the surface. There is one point at which there is a large dot, and that is a kind of seam through which the water penetrates into the interior.

'There appears to be nothing like these parts in the sea-urchin at first sight. But when we examine the star-fish on the lower side we find a very different structure. Here are five deep furrows. Under these furrows project long tubes in every direction, being the organs with which the animal crawls about. They are evidently, so far as use is concerned, the same organs as those which project from the sea-urchin. But in the sea-urchin we have them all united, while in the star-fish they are found only on the lower side.

'Let us see of what this furrow is made, and how these tubes are connected with it. Each furrow is made up of a number of large pieces alternating with one another, and between them there are holes through which come the tubes by which the animal moves.

'Then, on the side of these broad tubes are smaller plates. Now these plates gradually taper in size until the whole is transformed into an angular furrow, having the same structure all the way through.

'At the end of each ray in the star-fish there is an eye. We have, therefore, everything on the lower surface in the starfish which we find over the whole body of the sea-urchin, with the single exception of the small circle on the summit of the latter, which is occupied by other plates.

'If now we proceed to compare these arrangements, we cannot fail to see a certain analogy between them. Suppose I should split an orange into five parts, and stretch these parts in every direction, thus forming a pentagonal figure (Fig. 33). The sphere is transformed into a star. Now the point on the upper side of the sea-urchin occupied by those small plates becomes divided, and transferred in the transformation of the star-fish to the five extremities of the rays of the star-fish. So that, though at first so flat they seem to be in a different position, they are in the same position. There is nothing changed, except that the little circle occupying the summits of the sphere has been stretched, and its parts so multiplied that it extends over the whole upper surface of the animal.

'Now it becomes very apparent that this problem was easy; that it required only an increase of the elements in one direction to build up the star-fish instead of the sea-urchin.

'*Facts like this show the immediate working of mind in the construction of the animal kingdom. It is not a kind of work which is delegated to secondary agencies; it is not like that which is delegated to a law working its way uniformly; but is that kind of work which the engineer retains when he superintends and controls his machine while it is working. It is evidence of the existence of a Creator, constantly and thoughtfully working among the complicated structures that He has made.*'[1]

Agassiz then takes the lobster as an example among the articulate class, in which the same thing as just described is effected in the same parts of one and the same animal; but I have not space to increase my already large quotations from his admirable work. Long may science be enriched by such books as this. It concludes, after his illustration of the lobster, thus:—

'It is something akin to the device of man to do as

[1] *Op. cit.* p. 119-22.

much work as possible with the smallest and simplest apparatus; and when the largest amount and greatest variety of work is produced by a particular invention, we consider the result as indicative of superiority of genius or inventive capacity. Here, in the animal kingdom, we see it illustrated to an extent which the best-trained mind can hardly follow, showing how far beyond our comprehension are the wonderful works of Nature. Even though we can make ourselves conscious that they are built by mind, and that it has pleased the Maker of all things to give us a spark of that life which makes us to be His children, formed in His image, that evidence is nowhere stronger than in the fact that our mind is capable of studying those works to a limit which approaches to a comprehension of their wonderful relation to one another.'[1]

[1] *Op. cit.* p. 127, 128.

CHAPTER XXVIII.

THE TELEOLOGICAL ARGUMENT CONTINUED.

Professor Haughton's Lectures upon Least Action in Nature.—Position of Bones and Sockets predicted by Mechanical Laws with certainty. Classification of Muscles.—The Prismatic.—The Penniform.—The Quadrilateral.—Skew Surface.—Economy of Force.—Nature has other views, such as Beauty of Form and Surface of Least Resistance, to consider.—Beauty one of the Pre-existing Conditions in the mind of the Creator.—The Tiger and its Triangular Biceps Femoris.—Penniform Muscle, that which lifts Wing of Bird.—Reasons why Penniform Muscle is used in Wing of Bird.—The back stroke.—Necessity to give greatest Force, that two given Angles of 90° each should be passed through at same Time.—Nothing tentative in any Branch of Nature.—The Human Heart.—Amount of Work done by it.—Its beautiful Structure.—Its Method of Work.—The Principle of 'Least Action' as applied to the Heart.—The Uterus.—Conclusion of the Three Lectures.

I WILL take my next illustrations from Professor Haughton's three lectures upon 'Least Action in Nature, illustrated by Animal Mechanics,' from which I have more than once quoted in the preceding pages. I would advise everyone interested in this subject to get the small pamphlet, which has been reprinted from the 'British Medical Journal,' at 37 Great Queen-street. I will venture to say that no unprejudiced mind can deny, after perusing these admirable lectures, that an overwhelming answer to Darwinism is to be found in Animal Mechanics. Most of the great facts educed have been worked out by Professor Haughton himself, and will be fully elucidated in his forthcoming work upon Animal Mechanics. I will only here give a short resumé of his lectures—a difficult task enough, considering that every line is full of information.

Professor Haughton starts with the hypothesis that, 'in every arrangement of bones, muscles, joints, and parts of animals, the motion must be such as it would be on the hypothesis that the muscle were a living, intelligent thing, trying to save itself trouble. We can calculate, as I will show you in the subsequent lectures, with a certainty as perfect as we can calculate the path of a planet, the position of bones and sockets as we find them in nature.'

I pass over much interesting matter—how the Professor discovered the co-efficient of muscular force in a strong and healthy man to be 104 pounds to the square inch; how he describes tendons, particularly showing in their form and distribution how essentially the old world differs from the new world monkeys; how Nature, in the formation of her tendons, *never* uses a grain too much of the glue of which they are composed. I pass on to his classification of muscles.

Professor Haughton divides muscles into—1, the Prismatic, where the fibres are parallel to each other from bone to bone; 2, the Penniform Muscle, where the fibres radiate at equal angles from a common tendinous line, and are inserted at each extremity into the bone; 3, the Triangular Muscle, where the fibres proceed from a fixed line, and are inserted, not into a point, but into a line so short, that we may, for practical purposes, regard it as a point; 4, Quadrilateral Muscles, where they are drawn in lines converging from one bone to another.

The quadrilateral muscle is in reality the triangular muscle with the top cut off. In nature it is found that the forms of quadrilateral muscles deviate from their plane, and form what engineers call a skew surface (Fig. 34).

This singular figure, in which all the lines are straight, and all the surface curved, varies in form in geometry, and Professor Haughton has discovered that the peculiar skew surface assumed by muscles is the beautiful hyperboloid of one sheet, and that the *pectoral muscle* in birds' wings, and the *adductor magnus* muscle in the human leg, are examples of this geometrical form. Thus Nature, for particular purposes, varies her usual mode of structure, and substitutes that which geometers have proved more applicable to the purpose intended; and that form which geometers, and only geometers, can produce. I will quote here Professor Haughton's own words:—

'The prismatic muscle and the penniform muscle possess the remarkable property, which can be demonstrated mathematically, that in their contraction no loss whatever takes place. Nature therefore, according to my principle, is entitled to employ these two forms of muscles whenever she pleases; she suffers no loss or injury by using these forms of muscles, and we find, therefore, they are both frequently employed. When

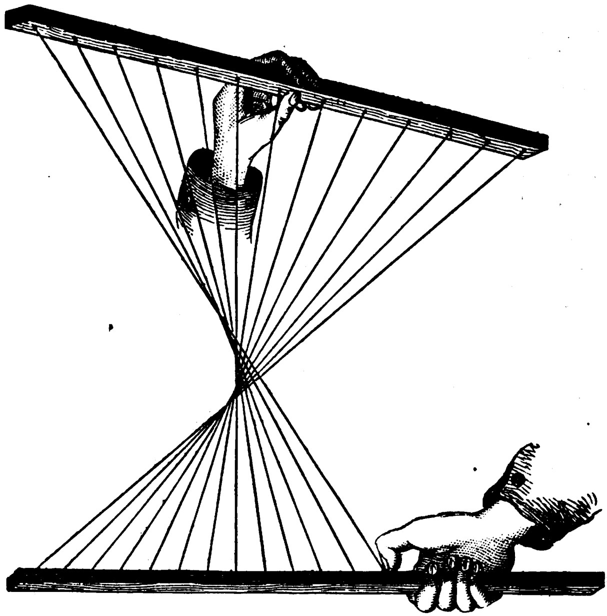


FIG. 34.—'Skew Surface,' showing the outside of the 'hyperboloid of one sheet.' Seen in the adductor magnus muscle of human leg, and the great pectoral muscle in the wings of birds. After Haughton.

we come to the triangular, the quadrilateral and skew muscles, we can demonstrate by mathematics that in the use of every such muscle there is a necessary loss of force. I may, therefore, be asked, How comes it, if the principle of least action be true, that Nature ever employs muscles involving a necessary loss of force? I answer, because Nature has other problems in view than mere economy of force in a single muscle. She has to consider, if she economise force simply, without regard to other circumstances, such as beauty of form and surface of least resistance, whether she might not lose rather than gain, taking into consideration all the conditions. I have always maintained that beauty of form, symmetry of outline, was one of the pre-existing conditions in the mind of the Contriver of the Universe, as well as economy of force. We find, therefore, that Nature never uses a triangular or quadrilateral muscle except under great necessity.'

Professor Haughton considers the tiger the strongest animal, and the most beautiful in nature; and he adduces the *biceps femoris*, the great flexor of the thigh of the tiger, as the most wonderful triangular muscle in the world. Now this great muscle extends in the tiger from the tuber ischii for a space of three feet along the side of its leg. This muscle exists in man and all other mammalia, and believers in Darwinism and evolution call the two muscles alike and expressive of genealogical affinity. It is arranged, however, differently in different animals; in most as a prismatic muscle, in man like a rope of parallel fibres. 'Why, then,' asks Professor Haughton, 'has nature deliberately sacrificed a certain amount of force by putting a triangular muscle into the leg of the tiger, to do the work which she does so effectually in my leg by a straight rope of muscle?' The answer is this—I am a man, and not a tiger; I am not intended, as a tiger is, to hide in a jungle; to jump from the jungle at a troop of horsemen going by; to take one of them and carry him off, spite of the rest, and eat him. That is not the purpose for which the Creator brought me here; but if I were brought here for such a purpose, I am sure I should have a triangular muscle in my leg. The weight of muscle to give the tiger the spring which enables him to do these feats is so enormous, that, if it were placed as a single rope from point to point, it would not only be a great deformity in his appearance, but would seriously impede him in his progress through the jungle. The clumsy nature of this enormous rope of muscle attached to him would injure him; therefore Nature has deliberately thrown over the first idea that might present itself, which was to put a great rope from point to point, and to make it strong enough. 'No, I cannot do that,' says Nature; 'I must preserve beauty of form,' making the tiger what it is, the most beautiful creature which God has created. Therefore the tiger is given a triangular muscle with a certain amount of loss of force, but there is a gain by spreading the muscle over a great surface, a gain in the packing and shape of the leg—there is more gained than lost by the apparent sacrifice of force.'

Professor Haughton then illustrates the use of the penniform muscle, which he describes as a rare muscle, and only used when there is a worthy object. 'The most remarkable example I can give you of the penniform muscle is the muscle which lifts the wing of the bird. The bird's wing is depressed by great and powerful muscles; it is lifted by a small compact muscle which is placed upon the breast of the bird, in order to keep the centre of gravity of the bird as far back as possible. It is worthy of remark that in the case of the ostrich, which does not fly, Nature places this muscle on the neck of the bird, because it is no injury to the ostrich to have the muscle on the neck, whereas it would be destruction to any other bird to have it so. This muscle is placed upon the breast-works by a tendon passing through a pulley, and changes through an angle of 180 degrees in its application, so as to lift the wing of the bird. The nature of a bird's flight is this. The depressor muscles of the wing must be made enormously great, to strike the air with the utmost force. The muscles which lift the wing must be made as light and small as possible, because their only object is to bring back the wing through the air after the stroke is made. This ought to be done in the shortest possible time, because while the wing of the bird is rising through the air the bird is falling. Therefore we find that Nature, or rather the Great Author of Nature, always employs the penniform muscle to lift a bird's wing; and for this reason, since the fibres converge at an angle towards each other, by compounding their forces the velocity along the diagonal is greater than it would be in a prismatic muscle. Thus no force is lost, and the bird is enabled to repeat the downward stroke much faster than if the prismatic form of muscle had been retained.'

Professor Haughton then points out the beautiful law that to produce the most powerful stroke, like the back-handed stroke of the guardsman, the back stroke of the paw of the tiger, and that of the racket-player, it is essential that the muscles of the fore-arm and the arm should be brought into co-ordination; and that, in doing this, it is absolutely essential that the muscles which perform the act should become perpendicular to the humerus, and those acting on the fore-arm perpendicular to the line joining the olecranon process of the ulna to the elbow-joint; in other words, they must pass through an angle of 90° at the same moment. 'We have the curious fact that the principle of least action in a tiger's fore-paw or arm requires that these two angles, which have no relation to each other, varying in magnitude at every moment, must, to produce the maximum effect, pass through 90° at the same moment. *And we find that Nature accepts the consequence.* I know no animal in which this law is not carried out, and a corresponding law to which I will now draw attention in the hind leg.

'In the hind leg a line joining the centre of the hip-joint with the tuber ischii becomes at right angles to the resultant of the biceps femori muscle, whether triangular or prismatic, at the same moment that the muscles of the calf become perpendicular to the line drawn through the centre of the ankle joint. In the case of the hind leg the arrangement skips a joint. In the fore-arm the shoulder is related in this remarkable manner to the elbow-joint. In the hind leg the hip-joint is not related to the knee-joint, but to the heel; and these two angles, which have no necessary relation whatever to each other, made by one group of forces at the hip-joint, and another group of forces quite distinct from them at the heel, pass through 90° together. One of the most remarkable instances on record of the skill, contrivance, and forethought with which the frame of animals has been constructed.'

Professor Haughton, in commenting upon these facts, beautifully refers to the man seen by passengers in the engine-room of a steamer, who, in oiling the machinery, would inevitably lose his life if he did not know to the tenth of an inch the movement of every bar, and adds; 'When we see these motions regulated by the intelligence of the engineer who contrived the machine, describing these angles, and passing through each angle at the exact moment the engineer intended, no person is fool enough to believe that there is not *contrivance* and *design*. I am ashamed to say there are intelligent men who can look upon similar structures more wonderful in the world of Nature, and not recognise the hand of Him who made them.'

Professor Haughton chooses the opportunity of showing how the use of peg-top heels by ladies must destroy the beautiful play of angles and joints from coming into effect, sacrificing in movement what is supposed to be gained by grace, and concludes thus:—'If the practice continue, I should expect that our young ladies of the future, between the bright colours of their heads, and the development of the tendons of their feet, will present an appearance not unlike the flamingoes that strut about the Zoological Gardens.'

It will well repay perusal to follow Professor Haughton into the application of his principle of least action to the wing of the bird. Acting upon this principle, he *predicts* the position of its angle of rotation. He does so in the albatross, grebe, macaw, wood-pigeon, pheasant, and heron; and in every case the calculation comes so close to the known line of rotation that there is no doubt of its truth, making allowance for the 'residual phenomena' to which all such investigations are subject. He concludes this lecture thus:—

'We find then nothing tentative in any branch of Nature. There is nothing tentative in astronomy. No planet ever seeks to move more perfectly in its orbit; it does so from the beginning. We have no evidence that light describes its path by a succession of attempts; it is singly, doubly, or conically refracted, according to fixed conditions, and has all the appearance of always having been so. The socket and the axis round which birds' wings revolve are placed exactly in the position best suited to produce the best effect.

'And here again I find no tentative process. There is no evidence in Nature of birds with imperfect wings; no proof of a succession of blunders before perfection was attained. All is perfect, and all was always perfect. There have been no "tentative miracles" in Nature, no failures nor trials. The graceful limbs of the beautiful tiger, and the expanded wings of the sweet albatross of Coleridge, speak to the ear of reason in language that cannot be misunderstood—

The hand that made us is Divine.'

The last of these beautiful lectures treats of 'least action' as applied to the heart and other involuntary muscles.

After asking his hearers to take for granted any apparently missing link in the argument, the result of ten years' hard study, which the one hour of lecture enabled him only to detail briefly, Professor Haughton deals with the amount of work done by the heart. He goes into detail about the method he pursued amongst many difficulties in finding the amount of weight which an ounce of the heart could lift. His answer is 20·576 pounds, through one foot every minute. This discovery was verified by obtaining the number of vibrations per minute made by contracting muscles, as shown by the musical note they produce, and which anyone can hear for himself if he will go into an empty room, and leaning upon his elbows against the table, allow the muscles of his arm to contract, and then place the forefinger of each hand into each ear.

By comparing these vibrations with the result of weight placed on the extended arm, he found a second co-efficient for each ounce of muscle which came out twenty pounds.

Well, then, taking the amount of work done by every ounce of the heart, he wanted something wherewith to compare it, and he soon found out this. He got the data of the Oxford boat race, the distance, the time, cross sections and plans of the boat, and then, using Rankine's well-known formulæ for the resistance of ships, he found that during the average twenty-three minutes of the race every ounce of muscle in the arms and legs of the rowers works at the rate of 20·124 pounds lifted through one foot per minute. Thus the heart of an old man close upon 100 years of age has worked for that 100 years of his life as hard as the muscles of the young men that pull in the Oxford and Cambridge eight-oared races.'

But then, as Professor Haughton remarks, 'How does the heart do this work?' If the principle of least action be true, the law of muscular contraction, is that each fibre when it contracts is shortened by one-ninth, therefore the fibres of the heart must be so arranged as to admit of such a contraction.

The heart has been compared to a ball of twine, and, more correctly, to two balls of twine containing a third—for there are two cavities, and certain groups of fibres run round each of these cavities, while a third group runs round the entire heart—all of which may be seen in Dr. Sibson's beautiful work on 'Medical Anatomy,' or the monograph of Mr. Pettigrew, who has added much to our knowledge of this exquisite structure.

Imagine millions of fibres being wound up in this manner, but every one of them in its proper place. If perfect order and system and design were not brought into play in the winding of these fibres, the heart would be spoiled. Professor Haughton believes the law which regulates these fibres to be that 'the spiral fibre which goes round the entire of the two cavities of the heart describes a complete circumference of 180° before its return, whereas the spiral fibres that surround the right and left ventricles of the heart respectively describe an entire circumference and one-fifth over before they come back. This extra fifth of a turn is, I believe, for the purpose of giving a twisting motion to the cavity, just as you would wring a cloth, so that it should be completely emptied at the close of the stroke, and no blood left remaining in the cavity, or even the least loss of force occasioned.'

Now these fibres are each of the same length in each group; therefore they are able to contract one-ninth of their length when ordered to do so by the brain, and the 'principle of least action has been fulfilled.'

But the anatomy of the heart enables Professor Haughton to apply a crucial test as to whether 'least action' is, or is not, the great principle in muscular mechanism asserted to be by him.

This test is the prediction that the 'ratio which the volumes of the two cavities of the heart bear to each other may be found by the measurement of the lengths of the fibres that surround them.' 'Let L be the length of the fibres that go round the entire heart; let *l* be the length of the fibres that go round the left ventricle. Find these lengths and cube them. The ratio of these cubes will be proportional to the sum of the right and left ventricles divided by the left. There are theoretical grounds which I believe are almost of themselves sufficient to entitle us to believe that these two cavities are of equal volume, and therefore that this fraction will come out equal to two. I have taken, however, a more certain mode of determining this by collecting together all the observations of direct measurement of these volumes that I can find, and I find that the mean is 2·125.' Professor Haughton believes that the decimal of one-eighth must be struck off this. The most correct of his ten observers made it two. But the Professor proceeds to his own verification. He measured the common fibres of a great number of hearts of oxen, and found them to be 10·875 inches. He measured the length of the fibres going round the ventricles of the same hearts, and he found the mean 8·625. He cubed the numbers, and the result was 2·004. Upon this he remarks:—

'I believe that to be a remarkable result, and to entitle us to assert that the principle of least action applied to the problem of the heart is capable of solving it a step beyond what it has been solved, and bringing us within reach of the knowledge of one more of the wonderful laws of the Creator. How it would have rejoiced the soul of the great Kepler, had he known that the ratio of the length of the fibres in his own heart was in the proportion of cube root of two to one! Divine Geometry! Queen and mistress of philosophy, thy right to rule the sciences shall never be disputed.'

This least action as applied to the heart is, Professor Haughton remarks, simply making every fibre and particle of the heart do the entire amount of work that it is capable of doing. He compares the perfection of this structure with the efforts of human genius. The Armstrong 600-pounder gun was an attempt to make each of the eight rings of which it was composed bear its proportion of work, but it exploded, and only three rings were burst. Had it been perfect the eight rings would have burst together. 'That which human skill is not able to effect is solved in the arrangement of the fibres of the heart of every person in this room.'

Professor Haughton then alludes to ellipsoidal muscles, of which the mammal uterus is an example.

This muscle is grown for a particular purpose—that of the birth of the young. It must acquire a certain power, not by use, for this does not come into play till the moment it is required. It must overcome a certain amount of resistance, which Professor Haughton, upon the principle of least action, calculated to be that an hydrostatical pressure of 3·4 lbs. per square inch could be produced by its contraction.

Dr. Mathews Duncan of Edinburgh and Professor Tait found by actual experiment that this was 3·1 pounds per square inch. 'Here we see Nature attaining perfection at a single bound, by a process of foresight. There is no evidence whatever of the supposed necessity of an endless succession of previous blunders.'

By this discovery Professor Haughton has solved the difficulty of the equilibrium of an elliptical dome. There is only one perfect dome of this kind in the world, that of the Pantheon in Paris, fortunately saved during the revolution. St. Paul's requires support; St. Peter's is strengthened by hoops of iron; Brunelleschi's dome at Florence is equilibrated, but then it is octagonal.

Professor Haughton concludes his lectures in the following words:—

'In conclusion, let us suppose that this and all other branches of science which man can study have been carried to their utmost perfection; let us suppose that man has fully explored all the secrets of Nature he is capable of attaining, and has found a key that unlocks all her mysteries, he will still find himself only a worshipper in the temple and before the altar of an unknown God, whose true nature and moral relations to himself must be sought from other sources than those which Nature furnishes. There are truths in the system of things as real and as certain as any laws of Nature, although we cannot perceive them with our senses. My eyes cannot see them, my ears cannot hear them, nor can I touch them with my hands; but they are there, I know them to be true, and that they will endure when Nature and her laws have passed away like a troubled dream. I testify what I have seen. I have many a time seen an humble earnest faith in these unseen truths cause a smile of joy to play upon the pale face distorted with pain, like a sunbeam dancing on the bosom of the troubled ocean. I have seen these truths illumine with a light from heaven the dim eye, soon to be closed for ever by the cold hand of death. These truths are more dear to me than all that Nature can teach me, because they touch my inner life and consciousness. I learned these truths as a little child upon my mother's knee; I cherish them in my heart of hearts; and in defence of them, if opportunity should offer and God should count me worthy, I would gladly lay down my life.'

CHAPTER XXIX.

EVOLUTION AND THEOLOGY.

The Teleological Argument inexhaustible.—Evolution and Theology as advanced by Mr. St. George Mivart.—His Dogma of Evolution. - Belief in both Theism and Christianity inseparably bound up with the Dogma of Creation.—The Fathers Evolutionists.—Reasons for rejecting their testimony on this subject.—The Soul separately created. Mr. St. George Mivart's Theory of Evolution shown to be untenable. —Its Difficulties cognate with those of Darwinism.—Conclusion.

No good purpose would, I think, be obtained by continuing illustrations which in fact have no end. I might have shown the inimitable perfection of the human larynx to be utterly inexplicable upon any other than a teleological ground of argument. I could have shown how the thoracic duct was guided by Infinite Wisdom to open its precious contents in the angle formed by the veins of the neck, just in the little spot where there could be no regurgitation of blood nor current force to check the flow of chyle.

I could have taken every organ or limb of the body, and have produced unanswerable proof of an ever-present, designing, thoughtful, and wise Creator, acting not by miracle, as weak reasoners assert; nor by supernatural means, as the biassed believer in secondary laws says so often; but by the simple, grand, overruling Providence of the Omnipotent and Omnipresent Author of all good.

The teleological argument is in fact inexhaustible; and no reasoner has ever yet obtained a *locus standi* from which it might effectually be assailed.

The embryological similitude between different forms of animals is not a real likeness—it is merely the same means adopted to carry out similar ends or functions in the organisation of living things. The mammalian heart is similar in structure through the series. Would it be sound or just to say that because a dog's heart and a man's are similar they are therefore genealogically related? The same argument is applicable to the whole series of mammalians left out in the cold by Mr. Darwin. The Master Mind deviates neither to the right nor to the left in carrying out the scheme of creation.

As we have just read, His work displays the constant presence and superintendence of a Great Intelligence; and if one animal has the same means of walking, breathing, or eating as another, it shows that method and plan are uniform throughout Nature.

The work, as Agassiz has remarked, is not such as could be relegated from a master to a workman; neither are the facts consistent with the operation of secondary laws, as surmised but never proved by the disciples of Darwin.

Is evolution or creation by secondary laws THE mode by which the world was created?

The opinions of many eminent men who are opposed to Darwinism are in favour of such a view, and by no one has it been more ably argued than by Mr. St. George Mivart.

'Without a distinct belief in a personal God,' says that pleasing writer, 'it is impossible to have any religion worthy of the name; and no one can at the same time accept the Christian religion and deny the dogma of creation.'

This seems to comprise the entire question, and Mr. Mivart believes that creation is the evolution of organic forms; and he thus defines the evolution in which he believes:—'It is the manifestation to the intellect, by means of sensible impressions of some ideal entity (power, principle, nature, or activity), which before that manifestation was in a latent, unrealised, and merely "potential" state—a state that is capable of becoming realised, actual, or manifest, the requisite conditions being supplied.'[1] And he says the 'evolution of specific forms' means the actual manifestation of special powers of nature which before were latent, in such a successive manner that there is in some way a genetic relation between posterior manifestations and those which preceded them.[2]

We are much indebted to Mr. Mivart for having distinctly admitted the fact that a belief in both Theism and Christianity is inseparably bound up with the dogma of creation.

[1] *Genesis of Species*, p. 270.

[2] *Op. cit.* p. 271.

Had he written no other words than these, he would have been entitled to the thanks of the scientific world. The admission scatters to the winds all the bitter things that have been said about the *odium theologicum.*

But does Mr. Mivart's definition of evolution 'correlate all phenomena'? Does it carry us any nearer to a solution of the great mystery—the How? I fear not. It is satisfactory to find that St. Augustine, St. Thomas Aquinas, and Suarez were evolutionists; but I fear we must gently remove these eminent divines from the scientific argument, for it is evident that there are a great number of theories of evolution, and the manifestation of these divines is hardly congruous with the meaning of either Mr. Spencer Herbert's or Mr. St. George Mivart's definition.[1] In fact, I wish Mr. Mivart had not quoted the Fathers, inasmuch as neither the 'Origin of Species' nor the 'Genesis of Species' were attempted by those holy men; and everyone possessed of reason, who had ever reflected upon the evolution of an egg into a chicken, must have believed in the potentiality of living matter. But the question to be decided *now* is a very different one from that.

Let us put it fairly and plainly. In Mr. Darwin's last work he has enunciated the doctrine of man's descent from the ape, and he considers his theory of

[1] This question has been argued at length by Professor Huxley, in the *Contemporary Review* for November, 1871, since the text was written.

natural selection sufficient to justify his doctrine. Mr. Mivart believes the same as to man's corporeal frame, reserving the soul for a distinct and special creation by the Almighty. But the difficulties which Mr. Mivart and others have shown to lay in Mr. Darwin's path may be clearly found upon that of Mr. Mivart. The latter does not fill up the gap between the ape and the man, while the former tells us that his evidences are at the bottom of the sea. Mr. Mivart, seeing the difficulty, has thrown overboard the accumulation of minute differences through variation and natural selection, and believes in a *per saltum* genesis of species. But he fails to see that the latter belief annihilates his own doctrine. If Mr. Darwin's evidences are never found, or never existed, then the creation of man was a direct, special, and so called miraculous act of the Creator, and both Mr. Darwin and Mr. Mivart's doctrines fall to the ground of necessity.

Then there is an ambiguity about Mr. Mivart's doctrine of evolution, which implies that it has been drawn up rather to meet existing prejudices than to account for the origin of species. It is calculated to meet the theistic belief, but the value it attains in this respect is lost by its greater obscurity. It implies a process in the genesis of species identical with that of the evolution of the chicken from the germ in the egg, but it is burdened with the proviso that it acts by *laws for the most part unknown*. If so, it must be incapable of demonstration, for no one will pretend that man may be evolved, *per saltum*, from an ape by an evolution similar to that which attends the development of the chick, most of the processes of which may be observed in the microscope, and all of which are congruous with and parallel to germination in all the groups of organic life. But surely Mr. Mivart will not contend that germination and the evolution of species are cognate phenomena! The variability of species may be accounted for by Mr. Spencer's or Mr. Mivart's formula. But the advent into the world of a new species, with intellect, reason, and an immortal spirit, can in no way be degraded into comparison with a pigeon fancier's artificial and production of monstrous varieties.

Let us take the beautiful instance of the internal ear as a special teleological production. Mr. Mivart gives us a figure of the fibres of Corti, and says he is unaware whether such a structure is to be found or not in the internal ear of the monkey; and if so it would be what he calls an instance of 'anticipatory development.'

In other words, he would say that the Creator in the beginning endowed matter with a secondary law, which would give a monkey for ages a most important and valuable structure which was never intended to be of any use to it. Why, surely this is Darwinism, *pure* and simple. One of Mr. Darwin's strongest arguments for the descent of one animal from another is the presence of useless organs, which were of great use to a predecessor. But then, a *per saltum* act of evolution from the ape to the man would imply the re-creation of the ear as well as other parts of the body, to suit the altered condition of the new reasoning being; which again, is simply admitting the doctrine of special creation, with the useless and purposeless addition of having a creature living for ages with a most exquisite structure in his ear which he was never intended to use, nor even have the satisfaction of evolving to a higher and nobler organisation.

On the whole, then, I think Mr. Mivart's doctrine of evolution cannot stand. It looks too much like Mr. Tegetmeier's pigeons 'made to order.' It is offered, with the best intentions, by an able and highly conscientious man, as a means of reconciling scientific and religious thoughts, and of bringing together the two lines which, Mr. Spencer remarks, are running parallel and gradually approaching each other.

Religion.

Science.

I do not think it has within it sufficient elements of truth to do this; but I am equally thankful to Mr. Mivart for having made the effort.

Truth is the great goal towards which all men of truly scientific mind are striving. The struggle is really one for existence. But will the fittest survive? Has the mind of man lost anything of its grandeur? Has it lost any of that purity, which, shining above all the littleness of earthly life, was not ashamed to proclaim truth in its own noble and unsullied greatness? Does the taint of hypocrisy, however faint, ever invade such a mind, guided by worldly interest, or expediency, or both? God forbid! Every honest man will sacrifice his all in the cause of truth, not as it is written or formularised, but as it exists, and will exist for ever, as a bright gem unsullied by a single flaw, shining on and on in its simple purity, ever piercing into the region of the unknown, but reflecting thence its rays upon a finite mind, and causing there a thrill of admiration, of awe, of wonder, of love, and of devotion; for that reflection reveals, in all its wondrous beauty, the thoughts, the plans, and the power of the Infinite.

APPENDIX.[1]

'Mr. Darwin has just published a book upon the "Origin of Species." The ingenious and learned author thinks that species are changeable. Unhappily he does not tell us what he means by "species;" neither does he give us any certain definition thereof.

'In the second place, he recognises very distinctly the variability of species; who does not? But he does not see the limits of this variability; and that is precisely what he ought to see. In short, the author uses everywhere a figurative language, which he does not explain, and which deceives him as he deceives those who make use of it. This is the radical vice of the book. By old writers Nature was personified — they gave to her inclinations, intentions, and views, horrors (of a vacuum)—and the sports (of nature) were attributed to her. Monstrosities were her errors. The eighteenth century did better. In the place of God it put nature. Buffon said to Hérault de Séchelles: "I have always named the Creator; but you have only to take that word away and replace it with the 'Force of Nature.'"

[1] The following is a literal translation of a part of the work of the late M. Flourens, entitled *Examen du Livre de M. Darwin sur l'Origine des Espèces*, par P. Flourens, membre de l'Académie Française, secrétaire perpétuel de l'Academie des Sciences (Institut de France). Paris, Garnier Frères.

"Nature," says Buffon, "is not a thing, for that would be everything. Nature is not a being, for this being would be God." In which he was perfectly right, but which, as we shall see, was not the cause of much alarm to him. He adds: "Nature is an active, immense power, which embraces everything, animates everything; which, subordinate to the First Being, only begins to act with this order, and only acts now with His consent."

'It is from this pretended Power that naturalists produce their nature when they personify it."

'M. Cuvier has, however, a long time ago averted from them all the perils of such language.

'By one of those figures to which all language is inclined, he says: "Nature has been personified. Living beings have been called the works of nature. The general bearing of these creatures to each other has become the laws of nature. It is while thus considering nature as a being endowed with intelligence and will, but in its power limited and secondary, that it may be said that she watches incessantly over the maintenance of her work, that she does nothing in vain, and always acts by the most simple means. . . . It is easy to see how puerile are those philosophers who give nature a species of individual existence distinct from the Creator, and from the law which He has impressed upon the movements and peculiarities of the forms given by Him to living things, and which He makes to act upon their bodies with a peculiar force and reason.

'As knowledge has increased in astronomy, physics, and chemistry, these sciences have renounced the false reasonings which resulted from the application of this figurative language to real phenomena.

'Some physiologists continue the use of it, because in the obscurity which still surrounds physiology they could only delude themselves and others respecting the profound ignorance in which they remain about all vital movements, by attributing some reality to the phantoms of abstraction.[1]

'In the following examination of Mr. Darwin's book I propose two objects. 1. To show that the author has deluded himself, and perhaps others, by a constant abuse of figurative language; and 2. To prove that, contrary to his opinion, species are fixed, and that, far from having proceeded one from the other, as he states, different species are and will remain eternally distinct.

'Mr. Darwin begins by imagining a "natural selection." He then imagines that this power of selection which he gives to Nature is similar to or parallel with the power of man.

'These two suppositions admitted, nothing stops him. He plays with Nature as he pleases, and makes her do whatever he wishes. The power of man over living creatures is perfectly known. Species are variable. They vary from each other. This all naturalists know, and no one has proved it more strongly in these modern days than M. Decaisne, in his direct and decisive experiments. Now, among the variations of species some are useful to men's views, and others opposed to them. Man chooses the useful variations, and discards those that are the contrary. This is not all. After having chosen individuals with useful variations, he unites them together, and by that means accumulates these varieties, extends them, and fixes and so makes races. This all naturalists know.

"Apropos of the dog," Buffon says, "man has created races in this species, by choosing and putting together the largest and the smallest, the best-looking and the ugliest, the most hairy and the most naked, &c."

'In his history of the pigeon, he says: "The maintenance of varieties, and their multiplication, depend upon the hand

[1] Cf. the article 'Nature' in *Dictionnaire des Sciences naturelles* (Levault).

of man. He collects together from nature the individuals which most resemble each other, he separates them from the others, unites them together, and takes the same care of the varieties which are found among the numerous productions of their descendants; and by continued attention, in time an infinity of new creatures, which nature by itself would never have produced, are created before our eyes—that is to say, brought to light. . . . The combination, succession, arrangement, re-union or separation of beings, depends often upon the will of man, since he has the power to force nature by his combinations, and to fix her by his industry. From two single individuals which are produced, as it were by accident, he will form a fixed and perpetual race—from which he will derive many other races, which, without his skill, would never have seen the day."

'These are the facts which Buffon saw, and which everyone knows. *Darwin has seen nothing more.* He has only added to all this a metaphorical language which dazzles, and he imagines that "natural selection," which he gives to nature, must have incommensurable effects (this is his own word) above the feeble power of man.

'He says, in express terms, that as all the works of nature are infinitely superior to those of art, so "natural selection" is of necessity ready to act with a power which is incommensurably superior to the feeble efforts of man. He says again, —if the principle of selection which we see so powerful in the hands of man could be applied to nature, how immense would be its effects! I have given, he says, the name of natural selection to that principle by means of which each variation preserves itself, provided it is useful; so as to make the analogy agree with the power of man's selection. That is to say simply, you have personified nature, and that is all the fault we find with you. "Many writers," says Mr. Darwin, "have criticised this term of natural selection. In the literal sense of the word it is a contradiction." It is impossible to describe it better; but then why make use of it? Why make all his explanations and all his books accommodate themselves to this false language? Why write an entire book in the false spirit which this language implies? Without doubt this is the constant method of Mr. Darwin. He begins by asking permission to personify nature, and then, by a *dato non concesso*, he reasons as though this permission had been granted to him. (Origin of Species, p. 119-20.)

'Thus he always speaks metaphors; nature chooses, nature investigates, nature labours, and labours without ceasing, and labours for what? To change, to perfect! to transform species. The transformation of species is, according to Mr. Darwin's system, the perpetual occupation of nature! What is there in this?

'This system is like any other, and it is not Mr. Darwin who has invented it. In the last century Demaillet, the author of the Telliamed, covered the entire globe with water during millions of years. He made the waters retire gradually. All terrestrial animals had first been aquatic. Man himself had begun by being a fish; and the author assures us it is not uncommon to find in the ocean fish which have only partly become men, but whose race will really become men at some future period.

'Maillet, of whom we have already spoken, Voltaire says, thought he perceived at Grand Cairo that our continent had been nothing but a sea in past antiquity. He saw some shells, and he reasoned thus: "These shells prove that the sea has been for millions of centuries at Memphis: therefore, the Egyptians and the monkeys have been developed incontestably from marine fish."

'After Maillet came Robinet. His book is well known, entitled "Essays of Nature: How to make Man." Maillet was a man of genius. He dedicated his book to Cyrano de Bergerac, to prove to him that we may speculate about the sea as we do about the sea and moon. Robinet was simply ridiculous. It is sad to find among these men of wild ideas the respected name of Lamarck—a true genius, except when he pretends that man has been derived from a polyp or a monad. Now, it is precisely for this that Darwin praises him. He says Lamarck developes the idea that all animals, including man, are derived from other anterior species, and that by so doing he rendered a great service to science. The fact is that Lamarck is the father of Darwin. He commenced his system. All Lamarck's ideas are, in reality, those of Darwin. Mr. Darwin does not admit this at first. He has too much art for that. He would frighten his reader, while he only wishes to captivate him.

'But when he finds the right moment has come, he says, neatly and formally, "I think the animal kingdom has descended from four or five types, and the vegetable kingdom from the same number or less." But in the midst of so many facts which he re-unites, and so many bold conclusions he draws from them, one observation strikes me. It is from these same facts Buffon, who was also of a bold and very systematic spirit, draws absolutely contrary conclusions. What Mr. Darwin calls perfection, Buffon calls degeneracy. His beautiful chapter on the degeneration of animals is well known. He passes in review all our domestic animals, and their varieties. All these varieties appeared to him so many particular alterations of each species. He says of the pigeon domesticated from a time immemorial: "As man has created all who are dependent upon him, we cannot doubt him to be the author of these slavish races, as perfect for us as they are degenerated and vitiated for nature." *But we must beware of Buffon, as we must be aware of Darwin. All imaginative people are systematic, and system consists in only seeing things* *from a one-sided view.* Happily, this great and fundamental question of the fixity or mutability of species has been treated by a naturalist who had as much good sense as Buffon and Darwin had imagination. This objection was raised against M. Cuvier relative to the lost races he has restored. "Why should not they be modifications of those ancient races which are found among the fossils—modifications which might have been produced by local circumstance and changes of climate, and brought to this extreme difference by a long succession of years?

'"This objection," says Cuvier, "ought to appear particularly strong to naturalists, who believe in the indefinite possibility of the alteration of forms in organised bodies, and who think that all species can change one into the other, or result from one only among them in the course of centuries, or from their mode of life."

'This is what he said of Lamarck, and would say now of Darwin: "I do not think this naturalist in earnest."'

'"As for those," continues he, "who recognise that varieties are restricted to certain fixed limits, we must, in answer to them, examine how far these limits extend—a curious research, very interesting in itself, but which has been little done or thought of till now."

'He gives himself up, then, to this research. He takes one species after the other, and determines in each the degree of variation of which it is capable.'

'"Though the wolf and the fox," he says, "inhabit the country from the torrid to the glacial zone, they hardly, in this immense space, show any variety beyond more or less beauty in their fur. I have compared the skulls of the foxes of the north with the foxes of Egypt and those of France, and I have only found *individual* differences. A thicker coat is the only difference between the hyena of Persia and that of Morocco. The skeleton of the Angora cat differs in nothing essential from that of a wild cat."

'He then comes to the dog; and here he undertook an immense work, in which he was assisted by his brother, Frederic Cuvier, the most exact naturalist I ever knew.

'"Dogs vary in colour and in abundance of hair, which they sometimes lose entirely; in form, in the shape of ears, nose, and tail, in the relative height of the legs, and in the development of the brain, and the consequent shape of the skull, &c.

'"And this is the maximum of known variations to this day in the animal kingdom, viz., there are races of dogs which have one toe more on the hind feet, with the bones of the tarsi corresponding, as there are in the human race some families with six fingers."[1]

'How far is all this from Mr. Darwin, and the *immense effects* which he makes his "*natural selection*" produce! Or rather, how much these facts, seen by themselves, differ from facts seen in a system founded upon the phantoms of abstraction.

'There are in animals characters which resist every influence. These characters are internal. The most profound of these characters is that of *fecundity*, and it is this which makes *fixity* of species. The *varieties* of our domestic animals are also innumerable. All these varieties are nevertheless fecund between themselves. All our dogs, horses, and oxen are fecund among themselves, and of a continuous fecundity.

'Different *species* united with each other have only a limited fecundity. This constitutes the GENUS. In short, fecundity decides everything.

'Species proceed from continuous fecundity, genera from imited fecundity.'

'*Orders and classes not having among them fecundity have no degree of consanguinity or parentage.*

' come back to my principal object—"Fixity of species." The acts are admitted and known to everybody. Mummies

[1] *Discours sur les révolutions de la surface du globe.*

of men have been brought from Egypt; the men of to-day are like those of former ages. They have brought mummies of animals, dogs, oxen, crocodiles, ibises, &c. All these animals are the same as those of the present day. The 3,000 years which have passed away since they lived have neither changed nor altered anything.

'It is 2,000 years since Aristotle lived. Guided by comparative anatomy Aristotle divided the animal kingdom as Cuvier divides it now. There were in it viviparous quadrupeds or mammals, birds, oviparous quadrupeds or reptiles, fish, insects, crustacea, mollusks, radiates or zoophytes.

'The animal kingdom of Aristotle is the animal kingdom of to-day.

'The animals of Aristotle which he has noticed are recognised in the present time, even to the minutest particular. Wonders are looked for, and are thought to be found in the pretended changes of beings.

'The greatest wonder is that species are *fixed*, and that different species remain eternally distinct.

'The "struggle for existence" and "natural selection" are the two pivots on which the system of Mr. Darwin turns. The "struggle for existence" is the perpetual war which animals wage against each other for their subsistence. . . .

'With Darwin there are two classes of beings—the one selected which "natural selection" continually ameliorates; the other cast away and always being exterminated by the "struggle for existence."

'By helping each other in this way, the two bring everything to a good end, which is that certain individuals should be ameliorated and perfected, while the others are annihilated.

'It is a generalisation of the law of Malthus, says Mr. Darwin, applied to the whole organic kingdoms. . . .

'Natural selection is only another name for Nature. For an organised being Nature is neither more nor less than organisation. One must therefore personify organisation, and say that organisation selects organisation.

'"Natural selection" is this substantial form which was formerly used with so much facility. Aristotle says that "if the art of building was in the wood, this art would act like nature." In the place of the "*art of building*" Darwin puts "*natural selection*," and each of them means the same—one is not more chimerical than the other.'

'But let us come from reasoning to facts. Does Darwin cite a single fact—even one—to prove that one species is changed into another? Has a mollusk ever been changed into an insect, or an insect into a bird? The more I reflect the more I am persuaded that Darwin confounds "variability" with "mutability." These are two phenomena, which cannot be kept too distinct. Variability is the variations, or the shades, more or less distinct, of varieties of the same species. They are all intrinsical; none leaves the species. Mutability is quite another thing. It is the radical change of one species into another, and *this radical change has never been seen.*

'Linnæus says, in speaking of varieties: "There are as many varieties as different vegetables produced by one plant;" and Decaisne has proved this—for he has obtained as many varieties as he has sown seed from one pear-tree.

'Darwin does not recognise the true character of species. He affects even not to believe in species. However, species exist, and if we cannot believe in them we can believe in nothing.'[1]

. . . .

'Darwin says of transitory forms, that they must have been exterminated; but if so, remains or traces of them ought to have been found. Mr. Darwin falls back upon fossil bones (p. 246). Blainville thought, in his idea of the unity of the animal kingdom, that species which are wanting in the series

[1] See Darwin's *Origin of Species*, pp. 69, 70, and 76.

of living beings must be found among fossils. He saw, in his examination of animals, as described in the "Elogé Historique," everywhere blanks and vacancies. "It was then, in a flash of genius, he discovered beings in past nature which are missing in the long chain, and which he interlaces, with surpassing skill, among living species. He was the first among naturalists to do this, and to discover for us the unity of the kingdom of nature." This view of Blainville ought to have been remembered by Darwin; *but Darwin only quotes authors who coincide with himself. He scarcely notices Cuvier, and Blainville not at all.*

'Here is another difficulty not so easily settled: we cannot here have recourse to fossils.

"'How is it, they say to Mr. Darwin, with your system of insensible gradations, that species are so well defined, and that everything is not in confusion in nature?"

'This last objection is *decisive*: between species which are always distinct, well defined, as Mr. Darwin says, and species always in the act of passing one to another, there is a formal contradiction. They continue.

"'How, for instance, can a terrestrial carnivorous animal be transformed into an aquatic animal? how could it have lived in its transitory condition?" It would be easy to demonstrate, replies Mr. Darwin, "that in the same group there exists carnivorous animals, which offer all the intermediate degrees between habits which are really aquatic, and habits which are exclusively terrestrial. As each of them only exists as the survivor in the "struggle for existence," it is clear that each of them must be agreeably adapted to its habits and position in nature." That is to say, that of two animals passing from terrestrial to aquatic existence, or *vice versa*, the one only exists when the "struggle for existence" has exterminated the other. "The process of extinction and that of natural selection march together," says Mr. Darwin. "It therefore follows that if we consider each species as a descendant from some unknown form, the parent form, as well as the transitory varieties, must have been exterminated."

'This case, then, appears to Mr. Darwin very simple; "but if I am asked," he adds, "how an insectivorous quadruped can have been metamorphosed into a bat, capable of flying, the question would be more difficult to solve, and I could not reply to it at once in a satisfactory manner."

"'I have, however, the conviction that similar objections have little weight, and that these difficulties are not insoluble."

'But, we say to Mr. Darwin, can we believe that "natural selection" succeeds in producing on one side organs of but little importance, such as the tail of a giraffe, to drive away flies; and, on the other side, organs of a structure as wonderful as that of the eye, of which we can scarcely understand the inimitable perfection?

'Let us stop a moment. How dare we put such questions with the hope of their being solved? Who will ever understand how the tail of a giraffe or the eye of man have been formed?

'Mr. Darwin asserts strongly, at the beginning of his book, that he gives nothing to nature but unknowing selection. In the literal sense of the word, he says then there is no doubt that "natural selection" is a contradiction; but I go on with my reading, and then I arrive at these words: "We must admit that there does exist an Intelligent Power, and this is 'natural selection,' which is constantly on the watch for every alteration produced, to seize with care those alterations which can be useful in any manner and in whatever degree." 'I should like, for the edification of my reader, to give him a complete theory of the formation of beings according to Mr. Darwin's hypothesis. But I remark, first, that his system has no beginning. The necessary commencement of every system which creates beings of all kinds is spontaneous generation.

It is no use fighting against it. Every system of this kind begins by spontaneous generation, or borders upon it. Witness Lamarck, Geoffroy St. Hilaire, and others, all following Buffon.

'Buffon imagines organic molecules. These molecules united form living beings. Animals already formed draw these molecules from the substance from which they derive nutriment. They use them for the purpose of nutrition. Once thus introduced, the organic molecules, indestructible and reversible, disseminate and mould themselves; the parts into which they are placed being the interior casts of the molecules. Once moulded, the molecules which have not served for nutrition are deposited in particular reservoirs, the seminal vesicles, and there similar molecules attract their like: those which come from the eye re-unite to form eyes; those which come from the arm re-unite to form arms, &c.; and it is thus, according to Buffon, that we have the origin or beginning of beings. Not making use of spontaneous generation, Mr. Darwin is reduced to create the species from other species. He forms actual beings from anterior existences, but there is very little sense in this. Ancestors follow ancestors without end.

'In natural history there are only two modes of origin possible; either spontaneous generation, or the hand of God. We must make our choice. Mr. Darwin writes a book upon the origin of species, and in this book what is wanting is precisely the "origin of species." This is the consequence of beginning too late. We cannot in the present day believe in spontaneous generation.'

'Happy Lamarck! He explains, says Mr. Darwin, "the actual existence of very simple organisms by supposing them to be derived from spontaneous generation!"

'M. Roulin, speaking of animals transplanted from the old to the new world since the conquest of America—viz., the pig, the horse, ass, sheep, goat, ox, dog and cat—says:—

'"All the above-named animals have more or less cast off their livery of domestication and returned to their primitive vestments of nature and liberty.

'"Wandering all day through the forests, the pigs have altogether lost their marks of domestication; their ears are erect, their head is broader, more elevated, the colour has again become constant, and is quite black; the young, with a coat slightly more obscure, are marked with yellow bands, like the young of the wild boar.

'"The horses are almost entirely abandoned to themselves. They are gathered together from time to time to prevent their becoming altogether wild. In consequence of this independent life, a character belonging to the species when not domesticated begins to show itself again, viz., the constancy of colour. Bay-chestnut is not only the prevailing colour, but almost the only one." M. Roulin finishes by this general observation: "Habits of independence appear to have a tendency to bring back the domesticated species towards the savage species from which they sprung."

'And now, what is this invariable tendency of species to go back always towards their origin? What is this inevitable reversion if it is not the definitive indication of their fixity?

'They evidently tend rather to re-new themselves than to pass into other beings—which is exactly contrary to Mr. Darwin's opinion.'

'Darwin's book has become an object of infatuation. The public, for some years, have been carried away in that direction. Lamarck began it. He admitted, without any difficulty, as we have seen, that species change—that they pass from inferior to superior—that they are always in a state of change, and, to speak like Darwin, in perpetual progress. To Lamarck succeeded Geoffroy St. Hilaire. He was not a man to stop such a theory. The doctrine of mutability increased under his auspices, and people became accustomed to it. At last

Darwin's work appeared. One cannot help being struck by the talents of the author. But how obscure and false are his ideas! What metaphysical jargon is thrown mal-apropos into natural history, which becomes nonsensical so soon as it strikes clear of all true and just ideas.

On the Hybridation of Animals, the result of his own experiments, M. Flourens writes :—

'Buffon had already seen a mongrel from a cross with the dog and wolf, and, under the surveillance of M. F. Cuvier, we have often had them in our menagerie. We cannot say as much of the mongrel between the jackal and dog. I believe I am the first who has produced them. In 1845 I obtained from the union of a species of the dog tribe with that of the jackal three mongrels. These three mongrels, brought up among puppies of their own age, differed from them at first by brusque and ferocious manners—like a savage brought up among civilised people. Their first dentition was much quicker than that of the puppies; but they were distinguished most by having two kinds of hair, like all savage animals, silky and woolly, while the puppies had only silky hair.

'Buffon had already stated that the fox would not couple with the female dog. My experiments have confirmed those of Buffon. A male fox would never couple with the female dog, nor the dog with the female fox. I am equally convinced that if they did couple there would be no results.

'Animals which differ by some marked character, such as teeth or organs of sense, are not of the same genus.

'The dog has the pupil of its eye discoid, and the fox elongated. The dog is diurnal; the fox sees better by night than by day. With such a difference in reference to such an organ, there can be no unity of genus. The dog, wolf, and jackal are all of similar structure, therefore the wolf and the dog, or the dog and the jackal, will couple. Buffon made a series of experiments on the reproduction of dog and wolf. He never could pass beyond the third generation. F. Cuvier, who was for thirty years the director of the menagerie in the Jardin des Plantes, could not get beyond this; nor could I either. With the jackal and the dog I went as far as the fourth generation, but I could not go further. My experiments among mongrels, perseveringly followed out, gave us the precise characters of species and genera. The character of species is continued fecundity. The character of genera is limited fecundity.

'We have already mongrels of several species. We know that the species of horse, ass, zebra, and hemione can breed with each other. Those of the wolf, dog, and jackal do the same, as we have just seen; and it is the same with the goat and sheep, cow and bison, she-goat and ram. The tiger and lion have produced in London, which is a remarkable fact, and upsets the principle which people were too hasty in forming, that for the crossing of two fecund species it was necessary that at least one should be domesticated.

'Nothing has been proved which has been stated of the pretended mongrel of dog and fox, dog and hyena, hare and rabbit, or of the bull and mare, or horse and cow. I have often attempted, and sometimes produced, the union of these animals, but they never proved fecund.

'We know that in the class of birds there are crosses between many species—the canary with the goldfinch, linnet, or greenfinch; domestic, common, and silver pheasants among themselves, or with the common fowl.

'I give the name of mongrel to the product of these crossed unions, because it appears to me to share the characters of each of the producing species. The mongrel between the dog and the jackal partakes equally of both parents. It has the erect ears, the pendant tail. It does not bark, and is as much jackal as dog. This is the first generation. I continue to unite from generation to generation the successive products with one of the two producing species—with that, for instance, of the dog. The mongrel of the second generation does not bark, but it already has pendant ears, and is less savage. The mongrel of the third generation barks, has pendant ears, and a raised tail. It is no longer savage or wild. The mongrel of the fourth generation is a perfect dog again. Therefore, four generations have sufficed to bring back one of the two primitive types, the dog. And four generations will, on the other hand, bring back the jackal.

'Linnæus said, with profound sagacity: "*Naturæ opus semper est species et genus; culturæ sæpius varietas; artis et naturæ classis ac ordo.*"

'In reality, species and genus are always nature's work; varieties arise often from cultivation; class and order partake of art and nature—nature giving to species resemblances and differences which are judged and appreciated by art. Species and genera distinguish themselves from all other groups of method in being founded, not only on the comparison of resemblances, but upon the direct and effective bearing of generation and fecundity.

. . . .

'If two distinct species, such as the dog and the jackal, wolf and dog, ram and goat, horse and ass, are united, they will produce offspring which is infertile, so that no durable intermediate species can be established. The horse and the ass have been united together for centuries; but the mulet and the mule do not give intermediate species. The same with the she-goat and the ram. They produce mongrels, but these mongrels do not give intermediate species.

. . . .

'The mongrels born from the union of two distinct species either unite between themselves and soon become sterile, or they unite themselves with other primitive stocks and speedily return thereto. They never form in any case what can be called a new or intermediate species. We have seen that the hybrids of vegetables, even of those which are fertile, return to one of the two primitive species at the end of four or five generations.

'Hybridity is therefore in no case, and in no sense, either in vegetables or animals, the source of new species.' I need not continue this translation further. Nothing can be more fatal to Mr. Darwin's hypothesis than the long-tested experiments of this distinguished Frenchman, who is seldom, if ever, noticed or quoted by Mr. Darwin or his school.

INDEX.

Spottiswoode & Co., Printers, New-street Square, London.