The three barriers : notes on Darwin's 'Origin of species'. / [By Gilbert Rorison].

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THE THREE BARRIERS:

NOTES ON MR. DARWIN'S

"ORIGIN OF SPECIES."

I said, Days should speak, and multitude of years should teach wisdom.

But there is a spirit in man: and the inspiration of the Almighty giveth them understanding.—*Job* xxxii. 7, 8.

Ergo ipsas quamvis angusti terminus ævi
Excipiat: neque enim plus septuma ducitur æstas:
AT GENUS IMMORTALE MANET, multosque per annos
Stat Fortuna domus, et avi numerantur avorum.

Georgic. IV. 206—209.

There are three that bear witness on earth . . . and these three agree in one.—1 *John* v. 8.

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MDCCCLXI.

The sudden passage from an irrational to a rational animal is a phenomenon of a distinct kind from the passage from the more simple to the more perfect forms of animal organization and instinct. To pretend that such a step, or rather leap, can be part of a regular series of changes in the animal world, IS TO STRAIN ANALOGY BEYOND ALL REASONABLE BOUNDS.—Lyell's *Principles of Geology*, B. I. ch. ix.

I should infer from analogy that probably all the organic beings which have ever lived on this earth have descended from some one primordial form, into which life was first breathed by the Creator.

It is interesting to contemplate an entangled bank, clothed with many plants of many kinds, with birds singing on the bushes, with various insects flitting about, and with worms crawling through the damp earth, and to reflect that these elaborately constructed forms * * * have all been produced by laws acting around us. * * * There is grandeur in this view of life.—*Origin of Species*, ch. xiv.

King: How do you, pretty lady?

Ophelia: Well, God 'ield you! They say the owl was a baker's daughter. Alack! we know what we are, but know not what we may be.—*Hamlet*, Act IV. Sc. v.

TO THE RIGHT REVEREND WALTER JOHN TROWER, D.D.

LATE BISHOP OF GLASGOW AND GALLOWAY,

AND TO WILLIAM LESLIE, ESQ. OF WARTHILL,

M.P. FOR ABERDEENSHIRE,

THIS VOLUME IS, WITH MUCH RESPECT AND REGARD,

INSCRIBED.

PREFACE.

THESE pages are the expansion of a Lecture written on Easter Monday and Tuesday of last year, and delivered the day after, in fulfilment of an engagement, at a small county town in the North. Somewhat varied, it was spoken a second time on behalf of a Mechanics' Institute in Aberdeen; and it was repeated a few weeks ago, in the same city, by request of the Young Men's Christian Association.

In acceding to wishes to which special weight was due, by preparing these sheets for the press, I have not thought it necessary to efface the original lecture-mould, or to expel allusions to which the statement now made will supply the key. The opening sentences, for example, are only suitable, in strictness, to the one occasion which suggested them, and to an address widely different from that into which this has since developed; but it seems pardonable to retain, even at some sacrifice of rigorous congruity, a tribute, however slender, to a great man gone.

To more than one living leader of British Science is the Appendix indebted for fresh decisions of the most authoritative kind on questions of the first importance. As regards the perfectness of the Human Eye, or the rank of the Human Brain, the testimony of Sir David Brewster and of Professor Owen ought to be an "end of controversy;" and a weightier judgment than that of Professor Kelland as to the evidence of geometrical forethought impressed on insect architecture is nowhere obtainable. To the prompt courtesy with which this distinguished aid has in each case been accorded, I must associate that of the accomplished Professor of Botany in the University of Aberdeen. The wood-cuts are mostly copies from "Siluria," and from the works of Professors Owen, Lindley, &c. They owe their excellence (with two exceptions, also meriting my best thanks) to the artistic skill of a gifted young friend.

G. R.

MAY 1, 1861.

CONTENTS.

APPENDIX.

'Thou makest thine appeal to Me:
I bring to life, I bring to death;
The spirit doth but mean the breath.
I know no more.' And he,—shall he,
Man, her last work, who seemed so fair,
Such splendid purpose in his eyes,
Who rolled the psalm to wintry skies,
And built him fanes of fruitless prayer,—

* * * * * *

Who loved, who suffered countless ills,
Who battled for the true, the just,—
Be blown about the desert dust,—
Or sealed within the iron hills?
No more? A monster then, a dream,
A discord. Dragons of the prime,
That tare each other in their slime,
Were mellow music, matched with him.
O life, as futile then as frail!
O for thy voice to soothe and bless!
What hope of answer or redress?
Behind the veil, behind the veil!

THE THREE BARRIERS.

1. Thoughtful working men of the north of Scotland, of whom not a few are here to-night, will not be slow to feel, with the present speaker, how much has been lost to the subject-matter of this address in the loss of one who commenced his memorable career in the north of Scotland as a working man. On first glancing over Mr. Darwin's pages, I could not help saying to myself,—What a pity Hugh Miller is dead! It was easy to see that this, in its patient ingenuity and probable influence, was no common book; and as natural to reflect that, had he been alive, it would have been met and sifted to the core by no common man. Of all our contemporaries, working men of the north, it was one who rose from *your* ranks—one whose hands were horny with hard mechanic toil—that was best fitted to grapple with this special task; and to render that crowning service

to the exposition of the harmony between Science and Faith for which all would have instinctively turned to him. But the contest has again come, and this champion is missing. We shall have no sequel from that pen, unrivalled in its combination of mastery of detail with felicity of treatment, to the legacy left us in the "Testimony of the Rocks," and the "Footprints of the Creator."

2. Not that there are not now living in this land men amply equipped to meet those shapes of scepticism which are the special danger of the present day. A genius of the order to which Hugh Miller belonged is not, indeed, born twice in a century. But Scotland is still worthily represented in the study of the Creative and Providential record.[1] So, too, in the south, one great English seat of learning counts among her most honoured names a name not unknown to the unknown author of the "Vestiges;" and has likewise arrayed, in "Indications of the Creator," her profoundest knowledge and her most masterly faculty in league against the dreams of pantheistic development. In days when a voice from Oxford, of ominous strangeness, makes haste to hail a predicted "revolution of opinion in favour of the self-evolving powers of nature,"[2] Cambridge "owes

us that counterpoise." To the latter University also are we incidentally indebted for that luminous survey of Transmutation of Species which exhibits Mr. Darwin in direct antagonism to the authority of the first comparative anatomist in the world.[3]

3. From those head-quarters of learned leisure, the detailed scrutiny of the new views, and of the promised elucidation of them, will doubtless, in due time, come.[4] To appraise aright observations and experiments in the more occult nooks of so vast a field, belongs to those who have made Mr. Darwin's speciality and the kindred branches of knowledge, the study and business of a lifetime. To them, in so far, we must defer; on them, in so far, rely. Pending their decision, however, on points of minor interest, it is not to be forgotten that there are certain broad inductions and governing facts which may be grasped at a cost of study and reflection short of lifelong. "Origin of Species" is one of those subjects on which, if a man has no fixed belief, and no good reason to offer for such belief, he must have been neglecting a culture which lies, in these days, at his very door. This is not a question for *savans* merely; it is a question for all men, in that they are men. As such let us look at it. In the first place, let us endeavour to seize distinct-

ly Mr. Darwin's meaning, and allow all due weight to his arguments. The bird that buries its own eyes does not blind the hunters ; nor will all the prejudice or prepossession that ever lodged in the human breast alter the nature of physical truth, or strip facts of the least particle of reality. On the other hand, let us be clearly apprised whither these arguments, if they stand the test, must lead us, in order that we may appreciate to the full our interest in the issue raised. To prove the origin of the higher animals from the lower, and of man himself from both,—this, in all its sweep of inference, not attempted to be masked, save by the flimsiest and most transparent of veils, is the true drift and purport of Mr. Darwin's book. "Come," the poet Rogers used to say, as he bent his steps to the monkey department of the Zoological Gardens,—"Come, let us see our poor relations." The words might serve for a motto to the "Origin of Species." What the poet meant in questionable jest, the naturalist means in downright earnest.

4. Reserving the mystery of the first spark of life, Creation, it seems, is its own Creator. Animals, from the least to the greatest, and plants as well, from the fungus to the oak, and from the ant to the elephant, have not been made, but have simply grown. All living

things have an immensely ancient, but a nearly, or, more probably, a strictly common ancestry. "Descent with modification" is the clue to the whole. The dairymaid and the animal she milks, the angler and the trout he captures, are strictly consanguineous, and sprung from a single stock. Nay, these are comparatively near "relations:" there is a cousinhood equally real, though more remote, between the angler and the tobacco he smokes, or the cow and the cowslip it is cropping.[5] The pedigree may not be recoverable, for its ramifications are prodigious; but a common pedigree there is. Lapse of ages, by the myriad, by the million, has left scope for innumerable divergent sproutings from the wide-spreading tree of Terrestrial Life; but these, diverse as they are, all spring from the stem, and are fed from the roots, of that one tree.

5. Seemingly a strain on faith; but an illustration is at hand to help us.[6] Certain forms of human speech are so palpably of kin that their common source is self-evident. The dialect of Aberdeenshire is not that of Ayrshire; but even its most salient and formidable peculiarities—a hopeless puzzle across the border—would be no enigma to a native of the west. At a wider remove, a Spaniard and a Portuguese might have harder

work in understanding one another; but they could easily see that their sister tongues had each a mother in the Latin. So Latin and Greek may be likened to first cousins. And what if there be a more distant cousinhood between two such seemingly discordant forms of speech as Greek and Gaelic? Yet so it is. From the same ancestral cradle, beyond all doubt, have these languages sprung—that which lent winged words to the wrath of Achilles, and that which greeted the pilgrims to the clachan of Aberfoyle; that which ministered to the rude requirements of Ranald of the Mist, and that which rolled sonorous, in golden periods, from the lips of Pericles, and from the pen of Plato.

6. If thus all languages are, or may be conceived of, as linked together, why not all living things? If Gaelic and Greek could spring from one root, why not, far enough back, a moth and a marsupial, or a marsupial and a man? Take only the base-line of the pyramid of language, and what can be less like than the forms represented by the extreme points *a* and *b*? Yet run the eye up the two lines of ascent, and suppose you find that these—Gaelic and Greek—through a series of insensibly diminished divergences, converge at *c* the point of departure. May it not be so with the pyramid of life?

Man and a moth, or even man and a marsupial, are, indeed, very far apart in the present; but may they not be brought to meet, and melt into one ancestry, along converging lines of minutely graduated transition produced into an indefinitely and almost infinitely remote past? The parallel looks plausible enough at first sight. Several months ago, in the course of a private conversation, I remarked that there could be no better illustration of Mr. Darwin's idea than what might be drawn from Mr. Max Müller's exposition, in his essay on Comparative Mythology, of the mutual though in part broken affinities of the entire group of Indo-European languages. I added that, while nothing could be more apt as an illustration, nothing could be more vicious as an analogy, or more feeble and faulty as an argument. To my no small surprise, in glancing next day at the then current number of a popular periodical,[7] I found the self-same comparison, suggested from the self-same source, in a paper styled "Studies in Animal Life." But the writer has overlooked those things that vitiate the assumed parallel. Suppose the pyramid of universal language *refuses* to run up into a perfecting point. Greek and Gaelic have a common parentage; but the same cannot be said of Gaelic and Chinese. If the Indo-European

family of languages be likened to the highest division in the animal kingdom, and the Chinese and other groups be paired off with the lower, then, on this writer's own showing, the main divisions at least must have a distinct original. But it is more important to note, that, whereas languages are mere collections of *words*, animals are organized *beings*. The former are flexible in virtue of the boundless plasticity of the mental processes they portray. The latter are framed on anatomical principles, and endowed with physiological functions, which rise as invincible *Barriers*, at a certain limit of permitted divergence, and say, if universal experience is to be trusted,—Hitherto, but no farther.

7. This, at least, is what our first authorities in Comparative Anatomy, such as Cuvier in the last generation, and Owen in this, have held, and do firmly hold and teach. And this is what Mr. Darwin, with great literary skill, and wide range of research and acquirement, is labouring with all his might to disprove and overturn. As others, indeed, have done before him; notably Lamarck, and the author of the "Vestiges." But what is peculiar to Mr. Darwin is the attempt to substitute a scientific and intelligible principle of animal progression for what, in these writers, as is now allowed on all

hands, is a mere fabric of visionary conjecture. He tries to slip a foundation under the Lamarckian scheme, and so to raise an unsubstantial hypothesis to the rank of a stable and fact-fortified theory. Species begets species, as individual begets individual; and the lower species, step after step, have begotten the higher—this line of assertion is common to all these writers alike. But the third claims property in a new instrument of conviction, a new scientific method, alleged to be based on fresh observation of nature—of avail, its author thinks, to prove what his predecessors only dreamed. And this he calls the principle of "NATURAL SELECTION, or the preservation of favoured races in the struggle for life."

8. *Artificial* Selection is as old as the patriarchs. Man has been, in rough fashion, a cattle-breeder from the days of Jacob, who produced varieties in Laban's flock,[8] down to those of Seth Wright, of Massachussets, the rearer of the once celebrated otter-breed of sheep, and to those of the unsurpassed boviculturists of Aberdeenshire. To such perfection, moreover, has this art come within this century, that one authority, Lord Somerville, does not hesitate to say—"It would seem as if breeders had chalked out on a wall the most perfect form of a sheep, and then given it existence." "Selection," Mr. Youatt

tells us, with a like hyperbolical licence of expression, "is the magician's wand, by which he may summon into life whatever form and mould he pleases." "In Saxony," Mr. Darwin himself adds, "the importance of selection in regard to merino sheep is so fully recognized that men follow it as a trade; the sheep are placed on a table, and are studied like a picture by a connoisseur. This is done three times at intervals of months, and the sheep are each time marked and classed, so that the very best may ultimately be selected for breeding." [9]

9. What holds of the various tribes of cattle applies more or less to the other creatures that have come under the immediate influence and control of man. The ox and sheep are modelled to suit the market, but a whim has given us our fancy-breeds of pigeons; and whim blends with an eye to fitness for work or consumption in the multifarious experiments on dogs, horses, and poultry.

10. Archimedes needs his fulcrum; and the pigeon, of all domesticated animals, is the selected fulcrum of Mr. Darwin. By the help of this feathered Proteus, his picked animal *paradigma*, he believes himself able to subdue to his hypothesis the whole feathered and featherless world of living creatures. On the one hand,

there is the original rock-pigeon, *Columba livia;* on the other, its curiously modified and metamorphosed progeny—the pompous fan-tail with its exuberant plumage, the pouter with its inflated crop, the tumbler with its curious somersaults in the air, the carrier, the trumpeter, and a host besides. These differences are esteemed by our author as exceedingly significant; such indeed as might surprise an ornithologist, were the birds found in the wild state, into a coinage not only of specific but of generic names.[10] Yet all this divergence consists with a common stock; all this can be brought about, within the limits of a species, by the *cultivation of peculiarities*, century after century, on the part of man.

11. Such the powers of artificial or human selection —of man as the educator of brute nature. But is this the *only* sort of selection by which animals can be modified? Mr. Darwin contends that it is not. Advantageous peculiarities, he holds, are incessantly fostered by a process quite apart from human interference. Which process is that of *Natural* Selection.

12. "The Empire," said the third Napoleon, "is peace." Nature, says Mr. Darwin, with at least equal accuracy, is War. The whole world of living things is one scene of struggle, one vast arena of truceless con-

flict, an unremitting competition for food and for existence. And the race is to the swift, and the battle to the strong. The table of nature is crowded with guests; the superfluous multitudes must be thrust out and trampled down. In this state of things, every peculiarity, however slight, which gives an animal an *advantage,* however slight, over its rivals, will not only improve the fortunes of the individual, but probably travel down as an heirloom to its offspring. Let a peculiarity which chances also to be a prerogative emerge, and let members of the favoured race, at distant intervals but in definite directions, go on accumulating the like advantages; and we are assured that in such case, from mere "varieties," which our author contemplates as "incipient species," there will issue fresh species, fully marked and developed, though not till after thousands or even myriads of generations. A peculiarity of this kind is deemed natural capital; and money makes money, it is thought, in the world of nature as in the world of man. There may and must be an infinity of failures, but there will be happy hits notwithstanding. In this fashion, according to Mr. Darwin, all the higher tribes have fought their way up through the incalculable periods of the past.

13. Incalculable periods. For, as the first factor in Mr. Darwin's scheme is War, so the second is Time. And certainly he is entitled to draw freely on the past. The sedimentary strata of Great Britain are nearly fourteen miles thick—Palæozoic = 10 miles, Secondary = 3 miles, Tertiary = ½ mile—and a typical diagram allowing for blanks and full development elsewhere, as in the Permian and later systems, of what is poorly represented in this island, would require for the whole series a scale enlarged by perhaps one-third. Now, what is a stratum? It is the spoil won by the sea from the dry land. Mark how ceaselessly the ocean lays siege to the shore; how indefatigably every winter the battering-ram of the billows smites on the coast-wall, and grinds it down. Every particle so torn away, or in gentler fashion gnawed away, *helps* to make a stratum. But this smiting and gnawing of the margin is as nothing to the atmospheric and aqueous abrasion of the surface. A stratum is substantially the *strewing* of what is swept off the land by rains and rivers on and over the floor of the deep; the tribute of the ocean of air to the ocean of water, of the waters that be above the firmament to the waters below. Here then is a great natural chronometer; the ocean is an hour-glass whose slowly precipitat-

ing and accumulating sand-drops tell off and register the life-periods of the earth. But to read that register other than roughly and approximately is beyond the best skill of man. The rates of deposition in ocean deltas, from which our data must be derived, vary with the volume and the rapidity of rivers, and the nature of the basins they drain. Then, again, the rate of deposition may have varied as widely at different epochs as it does in different regions. A high temperature with a moisture-loaded atmosphere, such as evidently prevailed in the Silurian period, supposes a strong impulse to the denuding agencies; and the process would be accelerated in proportion as the denuded surfaces were, as they are believed to have been, yielding and friable. On the other hand, the phenomena of organic remains are often such as yield the clearest proof of extreme slowness of accumulation.[11] As a fair gauge of average rates of deposition, consistent with these phenomena, we may take the calculated growth of sediment in the Bay of Bengal, which is about an inch in a century. Such the stratum-making power of the Ganges, less indeed than that of the Nile, but far greater than that of the Rhine;[12] and it measures off the age of the oldest water-woven rocks as approaching, at the least, one hundred millions

of years. Observe, of the sedimentary rocks; not of the globe, nor of life. The globe is indefinitely older; life, as we shall see by and by, according to our present evidence, is *relatively* much more recent. Still, even on this estimate, and with this deduction, that is an awe-inspiring vista which stretches upward to the dawnings of vitality on the earth. Any man who is nearing or passing the threescore-and-ten may form this rough reckoning to his own mind—that, for every year *he* has been alive, *Life* has lived at least a million. Suppose every human being in this populous city endowed with a life-lease of one thousand years, and each of these to be pieced on in succession to one another, this would no more than cover, if cover it did, the sweep of palæontological time. Or take the distance of the sun from the earth as miles, and thrust that into the stratified depths as years, you will let fall a plummet that will scarcely outfathom, if it even traverse, the abyss of that solemn antiquity.[13] Mr. Darwin, therefore, has ample scope for all reasonable demands on the lapse of terrestrial time. To be sure, when he exacts three hundred millions of years for a process which might, according to the observed rates of sea-encroachment on a tolerably impressible coast-line, be more feasibly restricted to three,[14] he

is betraying the bias bred by devotion to a favourite hypothesis. But it is needless to debate these figures. A myriad years or a million are much the same in an argument of this kind. The farther back, indeed, we carry the genesis of life, the more morally significant, by contrast, becomes the historic period, and the age of man. Even Mr. Darwin's enormous drafts will not break the bank of eternity.

14. Such the hypothesis. And doubtless Mr. Darwin has the signal merit of portraying, with a freshness and force altogether his own, what no preceding naturalist had seized with a like grasp—the important part played in the animal world by the constant competition for subsistence. Our author is the Malthus of Natural History. But it is one thing to discern the influential character of the struggle, and another to interpret its office or to decipher its results. Mr. Darwin insists that the struggle tends to *change of the type*, indefinite alteration of it for the better. Yet another reading, and an older, of the war of nature, is quite as likely to be true. What if animals were made from the first as "good" as they were ever meant to be; under no necessity of becoming better, though sometimes in danger of becoming worse? In that case the use of the struggle would

be preventive rather than promotive. Its function would be to *conserve the type;* to recruit and re-invigorate the primordial form; and to maintain unimpaired the relative perfection with which that form was gifted by the moulding hand of the Creator. That this, and not its rival, is the true account of the matter, we may speedily be satisfied, if, suspending our guesses, we simply use our eyes. Struggle, everywhere in nature, means death to the sickly, the ricketty, and the feeble; and life to the healthy, the well-knit, and the strong. But precisely as these latter are preserved, a guarantee for purity of type is preserved along with them. The physical beauty and strength of certain South American and Polynesian tribes struck all our early voyagers: the reason was that none but the pick of their offspring survived the hardships of infancy. But these men were not progressing, in virtue of this ordeal, towards a superhuman estate: their perfectness consisted in conformity to the type, and not in transcending it. The struggle exists as guardian of the standard, and the severer the struggle the more typical the type. Through all her domains, Nature weeds out the weak. Be it so. A strong buffalo, on that very account, will have worthy heirs to his strength, and a fierce feline carnivore to its daring and ferocity. "Natural

selection" fulfils and exhausts its office, not by fostering but by checking deflexion in structure. Those savage Red Indians who are said to have cast their young boys into a river, leaving those to perish who could not save themselves by swimming, would doubtless rear thoroughbred Red Indians: no more: not a race with a promise of fins. Just so the tested buffalo will grow up rigidly herbivorous; nor will the lion be set a-learning to eat straw like the ox.

15. Varieties will, indeed, arise which will be transient or permanent, according to definite and intelligible conditions. Permanent varieties spring from permanent causes—change of climate, supply of food, or the interference of man. Each of these, or any two, or all three of them combined, will produce, and that within a very limited space of time, extreme, though still superficial, diversities in size, colour, strength, and direction of natural instincts.[15] But none of these causes singly, nor all of them together, will work change in the dental formula, or the dorsal vertebræ, or the digestive and generative apparatus, or any other of those essential characters on which the comparative anatomist and physiologist rely. They will not disable the toxicologist from discriminating the blood-corpuscles of man from

those of a deer;[16] they will not endow a dog with the retractile claw of the cat; nor a horse with canine teeth. Yet these are the only class of alterative agencies known to experience and observation. Competition, under whatever name disguised—Natural Selection, or Struggle for Life—is not one of them. Certain changes in the superficial structure and habits of animals result from, and are perpetuated by, temperature, food, or artificial interference; but never, so far as we know, from free comity and intercourse, under like conditions, in a state of nature.

16. Transient peculiarities, it is true, will occur in individual animals—such as the short legs in Seth Wright's ram, born 1791, and selected, as disabled from overleaping fences, as progenitor of the otter-breed. In the same way, men and women have been born with six fingers. But, along with this licence of rare and casual *di*vergence, there is a law of constant *re*vergence by which it is effectually controlled. Save by artificial fostering, such peculiarities cannot hold their ground. Every other member of the species in which they appear is arrayed against them, and in league to obliterate them. There is no *variety* of six-fingered men; the sixth finger, or rather *bud*, for it is not a true digit—

having no metacarpal socket, like the phalanges proper —lingers on against hopeless odds through a few generations; at last it is absorbed and conquered.[17] Nature, so to say, sets her face against it; and puts it under ban as a fugitive monstrosity. The ancon breed of sheep, when it ceased to be profitable, and so lost its artificial guardianship, rapidly merged in the general mass. Under the same law of revergence, dogs, on lapsing into the wild state, lose the habit of barking and only howl.[18] So the wild boar of South America, after many centuries of intermediate domestication, has dropped the mask it was made to wear, and reappeared in the likeness of its prototype in the forest of Ardennes.[19] Through constant milking, the ordinary domestic cow has come to have teats larger than in proportion, and the secretion of milk is perpetual. In Columbia, from the size of the farms, the practice of milking was laid aside. With what result? "In a few generations, the natural structure of parts and state of the function was restored. If the calf dies, the milk ceases to flow; and it is only by keeping him with his dam by day that an opportunity of obtaining milk from cows by night can be found."[20] In such ways, nature shows her fundamental conservatism, and fidelity to

primordial form. Permitted perturbation is kept in check by the over-ruling law of equilibrium and recovery. Man's experiments on the lower creatures, then, so far from yielding an analogy to the methods of nature, present the strongest possible contrast. It is by suspending and crossing those methods that such experiments succeed. Man is a reformer, often a *de*former, and his influence over animals is innovation; it is the sole aim of nature to keep them up to the mark. She may be repulsed or counteracted, *tamen usque recurret.* We talk of the "unchanging east." Nature, save by the Creative will and interference, is more changeless than the unchanging east of man.

17. If we must apply the same name, then, to quite distinct and antagonistic processes, let it not be forgotten that natural "selection" is ever tending to efface such exceptional peculiarities in animal structure as human selection strives to cherish and perpetuate. All variation, moreover, howsoever brought about, is transacted within inflexible *limits.* Let the "magician's wand" be waved ever so dexterously, a sheep is still a sheep. In six years, we are assured,[21] Sir John Sebright will undertake to modify to pattern the head and beak of a pigeon: in how many more will he engage to turn the

milk which it is the wonderful prerogative of this family to secrete in the "crop," during the breeding season, for after mixture with the food of its young, into mammalian channels? For be it likewise carefully noted that such variation as is proved to be attainable, whether through human experiments, or under changed outward conditions, is not of the nature of *ascensive development.* To alter is not necessarily to elevate. To cultivate one point in an animal artificially, is to sacrifice another; and what the breeder calls "improvement" the naturalist deems deformity. Adaptive diversity may depress below the old level, but it will not promote to a new. At best it imports a power of conforming without injury to altered circumstances; but much more frequently degradation under hardships. Take the most decisive of examples, that of man himself. No conceivable change in food or climate will materially improve a robust and well-fed race. On the other hand, stinted food brings stunted stature. In Sligo and northern Mayo;—"Five feet two inches upon an average, pot-bellied, bow-legged, abortively featured, their clothing a wisp of rags; these spectres of a people that two centuries ago were well-grown, able-bodied and comely, stalk abroad into the daylight of civilization, the annual apparitions of Irish

want and ugliness. In other parts of the island, where the population has never undergone the influence of the same causes of physical degradation, it is well known that the same race furnishes the most perfect specimens of human beauty and vigour, both mental and bodily."[22]

18. Mr. Darwin's doctrine of *successive accumulation* is a marvellous stretch of that imaginative faculty which sits better on poets than on naturalists. It has been remarked that he "makes at any time but little use of the verb 'to prove' in any of its inflections," habitually preferring "I am convinced," "I believe."[23] Nowhere is this more manifest than in the failure to explain how one minute hypothetical acquisition in an individual animal is to survive undiluted through a thousand generations, to serve as a basis for the next. This is like saying that every specially tall, or specially gifted man, may expect on that account to confer on the indefinitely distant future a race of Shakespeares, or of giants fifty feet high. No such law of entail is seen anywhere in nature. Talk as we will of "elective affinities," the tall and the small among them restore the average, whether in *physique* or in intelligence. On a lesser scale, it is up to-day and down to-morrow, in the world of beasts as in the world of men.

19. Species, in its stubborn resistance to suppression —its existence as a fact in nature, and not merely as a classifying principle in the human mind—is no small trouble to Mr. Darwin. The discrimination of species resolves itself into three tests—diagnosis of Habitat, Structure, and Procreative Power. These tests may be styled respectively the aboriginal, the anatomical, and the physiological. Two living creatures, one in Jupiter, the other on the earth, cannot possibly be of the same species ; and a like criterion may sometimes be applied to forms of life, separated by impassable barriers, at different points of the earth's surface—*e. g.* the eyeless beetles of Hungary and North America.[24] This is the test of Habitat. Next, anatomically, a species is that which presents to educated inspection certain decisive specialities of structure, dorsal, dental, digital, or functional, such as obviously *seclude* the form in which they unite from other forms in which they are wanting ; constant characters which, in like colligation, are at once common to a certain group of animals, and peculiar to that group—found in *all* animals of that group, and found in *no* animal of any other. Lastly, there is the test of Reproductive Power. This depends on the axiom that *animals incapable of common off-*

spring cannot have sprung from common ancestors. While mere *varieties,* as superficial excursions from type are technically termed, are never mutually infertile,[25] animals of different species are physiologically contrasted with such varieties by reciprocal repugnance or punitive sterility. The mastiff and the terrier freely inter-breed; not so the horse and the ass: the mongrel dog is a parent; the hybrid mule is not. Putting aside the test of Habitat, we may say broadly, then, that the naturalness of the ultimate grouping of animals is proved by the coincidence of the morphological with the procreative test. Given mutual resemblance (whence *species*) in anatomical structure, there is also partnership in procreative power; given procreative power (whence *genus*) there is along with this fidelity to anatomical structure.[26] The application of these tests requires knowledge and care; and Mr. Darwin has dealt to species-mongers a just rebuke.[27] But the Linnæan maxim—*Species naturæ opus*—rests on foundations too broad and deep to be shaken by casual excess of statement or semblance of perplexity. This Mr. Darwin cannot help feeling to be a stumbling-block, on his ability to remove which the fate of his hypothesis depends. His first, and by far least formidable, task is

to find fertile hybrids. Great naturalists have maintained that none such can be found; but Cuvier declined to commit himself to this assertion. That all varieties are mutually fertile was clear; that almost all species are mutually sterile, if not in the first in the second degree, was clear also. Whether there were exceptions to this seemingly universal rule remained to be seen. Mr. Darwin, however, has found none. "It is difficult," he admits, "perhaps impossible, to bring forward one case of the hybrid offspring of two animals *clearly distinct*, being themselves perfectly fertile." And again, "I doubt whether any case of a perfectly fertile hybrid animal can be considered as thoroughly well authenticated."[28] Should it ever be so authenticated, the result would be the establishment of an exception to an all but unrelaxing rule, and the failure in that particular case of a test all but universally available. Other tests might indeed remain. If a wolf-like animal from Jupiter were to inter-breed with a dog-like animal from Saturn, and produce a fertile hybrid race, it would not follow that the two parents had sprung from one stock. Our author's account of his poor success in this first and easiest of his quests may prepare us however for a still more signal failure in that far less hopeful

quest which is vital to his main doctrine. No trace, none, of infertile varieties. The boundary line will not shift; species stands forth an inflexible frontier which no manipulation can "rectify." A prolific mule remains, as of old, a peg on which to hang a proverb for an impossibility;[29] nor will pouter and fan-tail, by refusing to breed, disown their common pigeonhood. The veto neither slackens nor spreads; nature keeps to her code of prohibited degrees, neither relaxing nor extending them. So huge is the difficulty that it earns for Mr. Darwin the special condolence of the *Westminster Review*. There is comfort, to be sure, and somewhat of compensation, in the thought that the ape is nearer man than the ape-like lemur is to the ape; but there is sadness, nevertheless, in the constrained confession that the facts of animal fertility and infertility cannot as yet be made to square with Mr. Darwin's scheme, or allow it to take rank as "*the* theory of species."[30] So these gentlemen are meanwhile in the plight of that brace of philosophers, one of whom devoted his energies to the milking of a he-goat, while the other—held the pail.

20. As matters stand, then, the horse, *e. g.* no more *explains* the origin of its near congener the ass, than either would explain an equine quadruped in Mars

or the Moon. And if this slight interval cannot be bridged, what shall we say to those other and incomparably greater chasms, not only confronting us in contemporary nature, but sculptured out to us on the sepulchral rocks, from top to bottom of the geologic scale, a million ages down ?

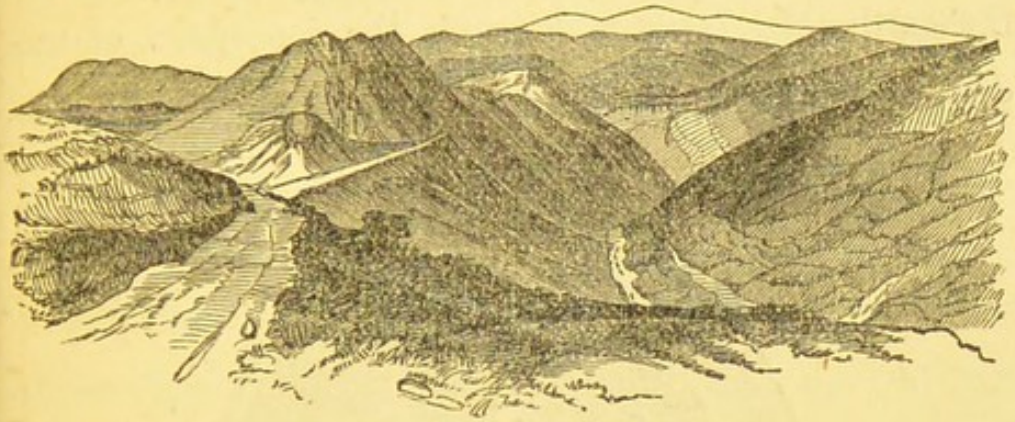
21. The tale told by the old graves of the earth, where nature has done her own embalming more effectually than Egyptian art, is all-important in the appraising of Mr. Darwin's scheme. And it is, on the face of it, as he feels, against him. His chapter on the geological record can only be described as an ingenious retreat from the facts of our knowledge on the possibilities of our ignorance. "Our theorists," says Paley, "having eternity to dispose of, are never sparing in time;" and Mr. Darwin, as we have seen, is most lavish in his drafts on the past. But the past, protracted at will, being against him, it is necessary further to suggest that if the past had been properly chronicled—if the museum of nature had been at all well kept—it might and would have been for him. No special pleading, however, can shake the facts. The rocky folds of the earth are now contemplated by its students, less as a succession of mineral masses than as a many-drawered cabinet of

fossil remains.[31] In obedience to this principle of classification, *Palæozoic*, *Mesozoic*, and *Cœnozoic* have taken the place of *Primary*, *Secondary*, and *Tertiary*, put forth when the science was in its infancy; and these names answer in Geology to the division of Universal History into Ancient, Mediæval, and Modern. If for every hundred years of history we put a thousand feet of stratification, we should further have a very close mnemonic parallel, marking off at once the ascertained depth of strata and the relative duration of the former life-systems of the globe. Neglecting the proportions, which, from the "lingula" or first distinct fossil-beds upwards, may be roughly estimated as 6, 3, 1, the chart shows in outline the state of the record.—(*Page* 38.) Of this, taken as it stands, no two readings are possible. All geologists who have no theory of species to propound, but only its fossil phenomena to register, are impressed with but one conviction, from the gradual dearth, the all but total, and the at last total disappearance of memorials of life from the lower Palæozoic strata—and that is, that life was just then beginning, or had not yet begun; for had life abounded in these lower zones as in the upper zones of the self-same system, it would have left, the facilities of preservation being precisely alike, simi-

GEOLOGICAL SYSTEMS.*			DOMINANT FLORA. AND FAUNA.	
CÆNOZOIC 5,000 Feet?	SUPRA-CORALLINE	Superficial Drift Mammalif. Crag Red Crag	Reign of ARCH-EXOGENS and ENDOGENS.	MAN. MAMMALIAN CLIMAX.
	CORALLINE	Coralline Crag	Fruit and Forest Trees, Palms, Grasses, &c.	Wave-brained Mammalia: Ape, Dog, Lion, Elephant, Ox, Whale, &c.
	SUB-CORALLINE	Paris Basin London Clay Bognor Beds	*Second Epoch of Efflorescence.*	Eocene Period: Bat, Dolphin, Bee, &c.
				Second Period of Organic Penury.
MESOZOIC 18,000 Feet?	SUPRA-OOLITE	Chalk Greensand Wealden	Dawn of Arch-Exogens.	Cycloids and Ctenoids: soft-scaled and pectinated Fishes.
	OOLITE	Upper Oolite Middle Oolite Lower Oolite	Reign of GYMNOGENS and ACROGENS.	REPTILE CLIMAX.
			Firs, Cycads, Ferns, &c.	
	SUB-OOLITE	Lias New Red Sandstone Trias Permian		Birds and Marsupial Mammals.
				First Period of Organic Penury.
PALÆOZOIC 60,000 Feet?	SUPRA-DEVONIAN	Magnesian Limestone Coal Measures Mountain Limestone	Dawn of Endogens. *First Epoch of Efflorescence.*	Reptiles, Insects.
	DEVONIAN	Old Red Sandstone	Dawn of Gymnogens.	Placoid and Ganoid Fishes: armour-clad.
	SUB-DEVONIAN	Upper Silurian Lower Silurian Cambrian	THALLOGENS. Sea-weed, &c.	First Fishes. Trilolites, Cephalopods, &c. Nearly Azoic.

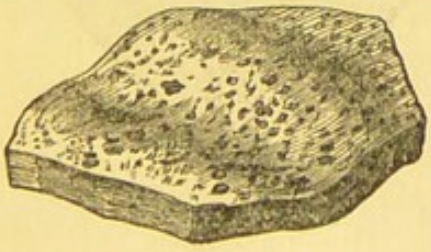
* In this Chart scale is disregarded, a large margin is allowed for under-developed Strata, and all the Geological Systems are referred to a *mid-member* of the main groups.

lar tokens of its presence.[32] The Longmynd in Shropshire is, in one view, the most interesting natural monument in the island; a mountain-range of the very



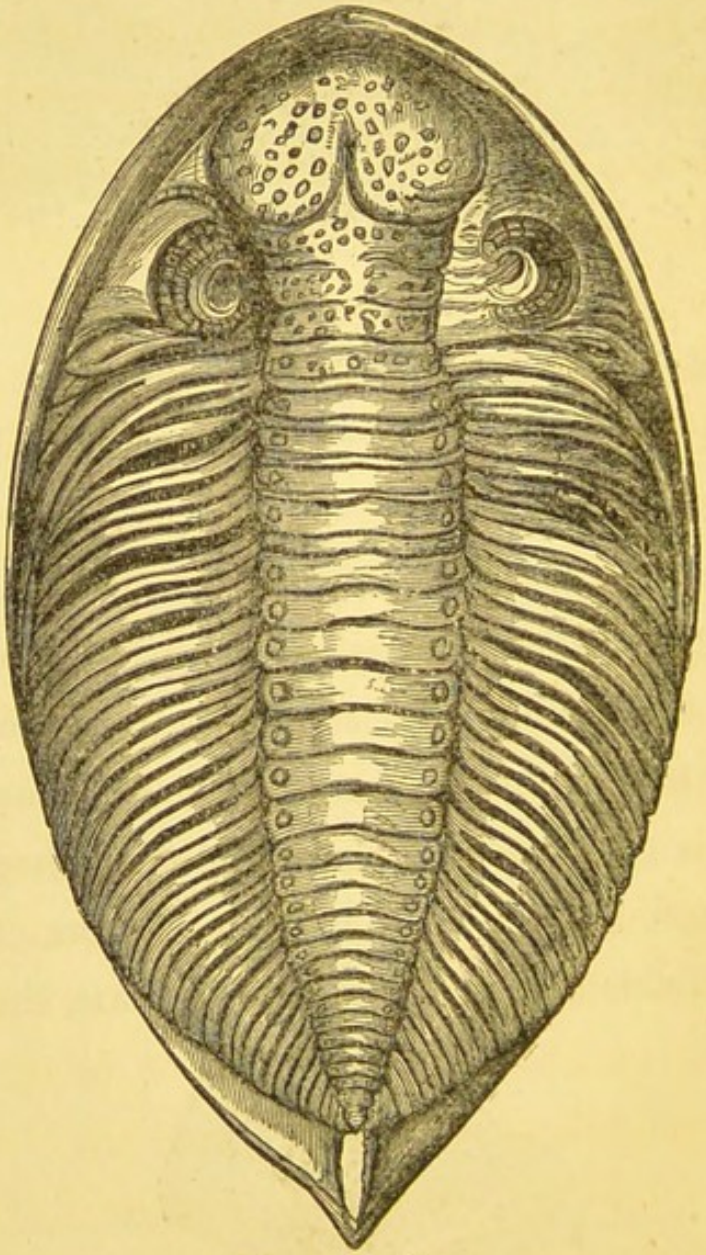
The Longmynd.

shadow of death, and yet cradling the first faint traces of the dawn of vitality. Below are the indubitable death-kingdoms of the granitic and metamorphic rocks. Above —for the geologist is privileged to pile ideally Ossa on Olympus and Pelion on Ossa—rise, teeming with organisms, the sister Silurians, yielding whole segments some fifty feet thick every fragment of which was once alive.[33] Between is the huge borderland, five miles deep, representing some five times five millions of years, of which, reserving dubious traces of a tiny sandworm, thus much



Traces of *Arenicola*.

may be said, that life throughout is perfectly FINDABLE, but has not been FOUND. So far from admitting, however, that we have here the true beginning of life on the earth, Mr. Darwin demands the concession of undiscovered strata, as much older than the oldest Sub-

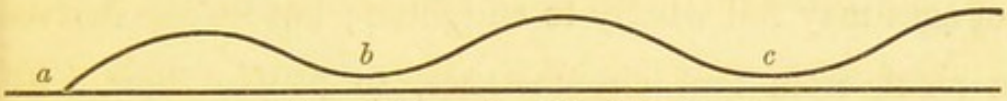


Phacops Caudatus.

Devonian rocks, included in the great Siluro-Cambrian series, as these are older than the youngest of known formations.[34] And this because otherwise life would start in Siluria *far too high in the scale* for the doctrine of natural selection. For its most typical form, the Trilobite *(page* 40), with its eye, in one species, of six thousand lenses, is as "fearfully and wonderfully made" as any crustacean in our present seas; and just on the upper edge of the system, ere it passes into the Old Red Sandstone, vertebrate life itself appears in the oldest of fossil fishes. On Mr. Darwin's hypothesis, life could not have begun thus: the ransacking of Siluria, east, west, north, and south—evidence which it would be an abuse of terms to call negative—bears witness that life did so begin. It is scarcely more evident, indeed, that life vanishes towards the base of the Cambrian rocks, than that man disappears ere we reach the Eocene. But our author's scheme has fresh exactions to make, and those of the most exorbitant kind, as we pass upwards from Siluria to the earth of to-day. Not only must we extemporise an imaginary fossil creation below, but we must interpolate vast piles of strata, and untold tribes of population, into the extant fossil creation above. The plea is, possible denudation. Now, although a consider-

able stratum may be in part so destroyed, few geologists will concede the likelihood, if the protective *dip* be taken into account, of its being utterly swept away. In point of fact, whatever blanks have appeared to intervene between the various systems are being rapidly filled up and bridged over. This is true whether we apply the test of conformable transition, or that of continuity of organic remains. "Every year," observes an unexceptionable witness, "adds to the list of links between what the older geologists supposed to be widely separated epochs. . . From M. Pictet's calculations of what per-centage of the genera of animals existing in any formation lived during the preceding formation, it results that in no case is the proportion less than one-third, or 33 per cent. It is the Triassic formation, on the commencement of the Mesozoic epoch, which has received the smallest inheritance from preceding ages." The other formations not uncommonly "exhibit 60, 80, or even 94 per cent. of genera in common with those whose remains are imbedded in their predecessor." [35] Consistently with this, it must be noted that the three great divisions are not arbitrarily drawn. *Proportion* may be exemplified on any scale—on the scale of contracting poverty as on that of expanding plenitude.

Once, and again, and yet again, is there a dawn and a decay, a protracted dwindling and an exuberant revival, a lull and an outburst of life-giving energy, a trough and a crest of the creative wave. But the phenomenon



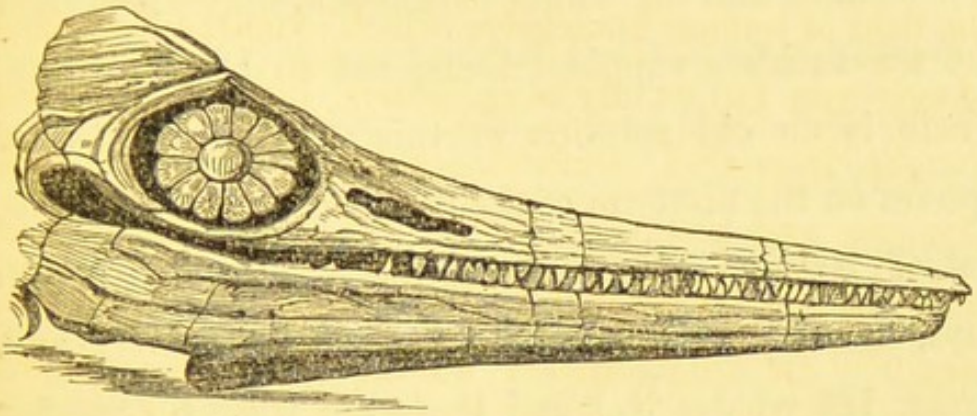
a, Hypozoic Zero. *b*, *c*. Life at the lowest.

of poverty of fossils, at the transition epochs, infers no interruption to the continuity of deposits. Whatever be missing then, here, in the main, are the rocks themselves. M. Pictet and the *Westminster Review* being witnesses, here are the platforms of ancient nature, the shelves of the vast museum from Siluria to the Tertiaries, for the purposes of this inquest practically complete.

22. But are these platforms sufficiently peopled? Are these shelves adequately filled? Mr. Darwin insists that they are not. Natural selection depends for its aliment on myriads of groups, of which it is necessary to suppose that the ocean catacombs have failed to transmit a solitary member. Species immensely more ancient have been preserved by thousands, but of myriads of these more recent forms not one representative has been preserved. This is surely somewhat startling.

If anywhere, the received aphorism which refuses to separate what does not appear from what does not exist, seems to apply here. "There are many dark places in the field of human knowledge, which even the researches of ages may fail wholly to enlighten; but no one derives a right, from that circumstance, to people them with chimeras and phantoms. They belong to the philosophers of the future, not to the visionaries of the present." [36] Of land-animals, indeed, the chance of preservation is comparatively very small. Yet even their remains, when the species existed to have remains to bequeath, are often found in extraordinary abundance. Witness the "ivory quarries" of Siberia, or the tusks representing hundred of mammoths fished up by the oyster-dredgers of the Norfolk coast, in the course of a few years of the present century. This even of land-animals; but what of the giants of the sea? Cetacean petrified teeth and skeletons are found in such quantities "as to constitute a great part of that source of phosphate of lime for which the Red Crag of the eastern counties of England is worked, for the manufacture of artificial manure." [37] Now, keeping in mind, as we have just been warned, that every year is tending to tone down those sharp demarcation-lines which parted sys-

tem from system in the conception of the earlier geologists, let us steadily contemplate the gigantic reptile-class swarming multitudinous in the seas of the Oolite,



Head of Ichthyosaurus: One-sixteenth natural size.

when the gigantic whale-class as yet was not; next survey the Cetacea, tempesting the waters of the Pliocene, when their reptile predecessors had passed away; and then calmly ask how natural selection will build us a bridge across the chasm? Did this agency convert a fish-lizard into a porpoise, or extemporize the faculty of giving suck to its young in a reptile "passing through the paths of the sea"? What scope for natural selection, bursting into the group of huge marine mammalia, amidst the monotonous and equable conditions of oceanic life? What creature *led up* to the whale or the dolphin? The saurians emerge on the geological stage, distinct, sharply defined: sharply defined they disap-

pear, to emerge no more. They are like the bird in the old story, coming out of the winter darkness into the king's feasting-chamber, and passing through its light and warmth into the winter darkness again.[38] And then the sea-sucklers supplant them, not so to pass away. There is an old solution of this vivid *apparition* of species on the platform of the past. It supposes a voice, not of Natural Law, but of Supernatural Will, which says, Let saurians be! and there are saurians; and, again, Let whales be! and there are whales. Species, on this view, come and go at the bidding of the breath of God. "When Thou hidest Thy face, they are troubled: they die, and are turned to their dust. Again, Thou sendest forth Thy breath, and they are created: Thou renewest the face of the earth."

23. That these successions have not been ruled on the purely competitive principle is one clear lesson of geology. Not always has the battle been to the strong; not always have the "favoured races" thriven best. Extinction, we are told, is the rigidly exacted penalty that is laid on the laggard in the race of life. And yet, as has been proved by a most laborious induction, throughout the immense Molluscan family, the higher the rank the lower the range: the headless bivalve,

with an equal start, has distanced and dispossessed the highly endowed cephalopod.[39] No living stag brandishes an antler comparable to that of the great Irish elk ; and the hugest shark now swimming in the seas is a dwarf by the side of its congener of the Miocene, measuring some sixty feet long.[40] Fishes take their place in ancient nature in four septs or squadrons, the two first separated from the two last by a prodigious interval ; but, notwithstanding their fierce instincts and their prescriptive occupancy, the cuirassed Placoids and Ganoids give way, and the unwarlike Ctenoids and Cycloids take possession of the field. Physical causes, of themselves, scarcely solve the phenomena of extinction and replacement on so significant a scale ; and the critical unpeopling as well as peopling of the waters throws new and purer light on that study of nature which introduced a Divine Destroyer into the Hindoo Triad. Why are not the saurians, and the monster shark, still scouring our contemporary seas ? Food could never have failed them in so stintless a storehouse, nor climate made war on them, nor rivals exterminated them. And yet they are gone. All that can be said is, that it was necessary to remove them, and — *they are removed.* If the Enaliosauria, or the fossil Carcharodon, were living gladiators

of the ocean, it could not be so fit a home for their mammalian superiors, and would even be blockaded against man. On seas teeming with these monsters, Arion could not have sailed, nor could the dolphin have disported beside his vessel. But the mammalia have not been left to fight it out with such foes. The animal competition has been modulated into consistency with the unfolding scheme of the Creative Providence. Obedient to no merely physical necessity, defeated in no pitched battle for the sovereignty of the seas, the fossil monsters shrank at another signal from disturbance of that new and higher order for which the appointed time had come, with which their co-presence was clearly incompatible, and which their brute strength, let loose, would infallibly have destroyed.

24. If it be one distinct lesson of the stony archives that the battle is not always to the strong, they teach with at least equal clearness that the race did not start with the weak. It is a vital postulate in all schemes of development—as vital to Mr. Darwin's doctrine as to that of Lamarck, of Oken, or of the "Vestiges"—that precedence is another name for embryotic immaturity and extreme lowness in the scale. Not only must the lower divisions ante-date the higher, for that simply

amounts to a manifestation of Divine Order in the introduction of living forms ; it is essential that each division shall make its entrance in some mean and dubious representative, some type closely osculant with those beneath it in the series. Mr. Darwin, as we have seen, confesses that the record does not yield this reading ; it must, he suggests, have dropped out. The older Scottish annalists, when inclined to romance on the buried glories of their country, used to make great capital of the destruction of attesting parchments by King Edward the first. I know a person who applied, in the early years of this century, to an octogenarian Jacobite clergyman for a certificate of the date of his birth. "My good youth," said he, "you should recollect that our registers were all destroyed *after the* '45"—some fifty years before the applicant was born. These shifts may be more or less amusing, but they are not satisfactory. In the investigation of ancient nature they are not even amusing. "*Asaphus gigas* is of Silurian, and *Pterygotus problematicus* of Devonian age ; this latter crustacean weakling would outweigh a couple of sheep : where are his ancestors ?" "They are lost." "Here are high cephalopods, *Lituites* and *Huronia*, almost as low-lying as any form of Molluscan life." "They are quite recent not-

Pterygotus Anglicus: One-eighteenth nat. size.
P. problematicus, 7 feet long.

withstanding." "Zones there are three of primæval nature: from the Ludlow beds upwards, a zone teeming with fish; from the Lingula bed downwards, a zone almost lifeless but for *Arenicola;* and a zone between, teeming with well-grown and well-marked Mollusks and Crustaceans. *Amphioxus,* on hypothesis, ought to be the

Old Red: Fish abundant.	Spine of Onchus.
Silurian: Crustacea, &c. abundant.	
Cambrian: Oldest Trilobites, *Arenicola*, Zoophytes, Fucoids: lower strata, azoic.	

father of fishes; and even lampreys or lancelets might

have left their print on the peaceful, plastic, and retentive mould which has kept so fresh the trail of a tiny sand-worm. But instead of *Amphioxus*, we have, in the eldest born of fishes, a grandee of the order—a member of the primatial family of sharks. The defensive spine betokens a congener of the sagacious dog-fish either greatly more bulky or much more powerfully armed; and so equipped, if the doctrine of final causes do not mislead us, for the purpose of protection against a fish, as yet undiscovered, *considerably more* powerful than itself.[41] What then of the status of *Onchus Murchisoni?*" "It is high because *Onchus* is young. There is a buried universe of fishes immeasurably older, a thousand million years or so, than he. *Cætera desunt* indeed; 'tis the fault of the register; and yet there is earlier writing, and the leaves are not torn out. For all that, it is certain that *Onchus* had an enormously-extended pedigree, though it cannot be recovered." We put the evidence again. "On the Sandstone of Connecticut are stamped the footprints of a creature to which the ostrich was a dwarf, and which strode, at its ordinary walking-pace, full six feet forward at a time." "This could not have been the eldest born of birds. It is the index to an immense previous development of the

class." Possibly, but the forest relics of the coal-measures have no earlier traces, so far as is yet known, to show. "*Archegosaurus* is a well-sized reptile of its order." "Frogs and newts had run their course up to *Archegosaurus* for millions of centuries before." "*Microlestes*, though comparatively minute, in accordance with the general character of the period, which was the golden age of saurians, still exhibits the typical mammalian dentition; and is no congener of *Ornithorhyncus*." "The duck-bill, nevertheless, must be believed to be by far the more ancient form." "The great mammifers start, all abreast and full-grown, from their terminus in the Eocene or Miocene. No whale relics lie entombed side by side with *Ichthyosaurus* in the oceans of the Oolite; no elephant tusks commingle with the bones of *Iguanodon* in the meadows of the Wealden. The tooth of *Mastodon*, nearly twenty pounds in weight, the skull of *Dinotherium*, ten feet in circumference,—whence came these? Like the battalions of an army, brought together by concert, and wielded by one will, the mammalian groups commence, from a common base-line, their march through the Tertiaries." "Their co-appearance is a difficulty, but each group *must* have countless ancestral forms, secreted no one knows where."

It is idle to call this an appeal to evidence. This is no reading of the record, but an escape from the record; a reading the record backwards. Mr. Darwin's business with the register is to open his eyes and look; he prefers to shut his eyes and dream.

25. "Can the Ethiopian change his skin, or the leopard his spots?" However deep into the past the soundings may go, constancy of species, persistence of type, is the answer brought back to the surface. Species may be compared to the elementary substances; as these of atoms, so those made up of units, capable only of the like alliances, and repeating substantially "the same biography."[42] The individual perishes, *at genus immortale manet.* Or if, on the large scale of duration which the ancient poet knew not, the species has its death-day as well as the individual, from first to last, like the individual, it keeps its proper identity. We may trace it far, or we may lose it soon; but so far as it is traceable it wavers not, falters not. The thread may be long, or it may be short; but it never changes its texture, or straggles into a something that is not itself. The writing on the wall of nature is not a series of ramified, yet mutually converging lines, running up into one root, but of lines strictly parallel and perpendicular,

traversing more of the scale or traversing less, beginning abruptly, ending abruptly; but such as if produced upwards would bring the type into the present, and if produced downwards would carry it into the Sub-Silurian past. Species *may* masquerade, Mr. Darwin holds it *must;* but it has never been caught masquerading. The ratio of Historic to Geologic time—of human literature and observation to the writing on the rocks—is indeed very small. If the Iliad, or Genesis, or the oldest Egyptian monuments be as 1, the remoteness of the Lingula zone may be put as 10,000; or even let us grant, age of the Iliad = distance of the sun, age of the Lingula zone = distance of Sirius. Yet though relatively small, it is not to be forgotten that the historic period is absolutely great. If a class of celestial objects or phenomena, generally analogous, lay along a line drawn between the earth and the sun and produced through the sun to a fixed star, a perfect knowledge of those phenomena on the route relatively so contracted would still afford a fair basis of reasoning for the partially inaccessible phenomena on the route beyond. Now the historic witness to the constancy of species is complete. Within the experience of man no new species has appeared and no old species been transmuted. The em-

balmed dogs of Egypt may seem to Mr. Darwin a broken reed: they impressed differently the great mind of Cuvier. "It might seem as if the ancient Egyptians had been inspired by nature, with a view to transmitting to after ages a monument of her history. That strange and whimsical people, by embalming with so much care the brutes which were the object of their stupid adoration, have left us, in their sacred grottos, cabinets of zoology almost complete. Climate has conspired with art to preserve the bodies from corruption, and we can now assure ourselves by our own eyes what was the state of a great number of species three thousand years ago."[43] These remains then have doubtless a unique value; but all ancient literature has the same tale to tell, and that none the less invitingly that it leads us not to the dissecting room, nor smells of the sepulchre. The camel that bore his bride to Isaac, and drew nigh as he was meditating at the even-tide, still projects the same outline, sharply chiselled on the horizon-wall of the eastern deserts, between the sky and the sand; the war-horse, "his neck clothed with thunder, and that said among the trumpets Ha, ha," in Syrian warfare, shows the same noble instincts on the battle-fields of Europe; and the dog that endangered the incognito of Ulysses

was but a living rehearsal of the favourite of Abbotsford. The animals so indelibly photographed in the pre-historic fable of the Aryan nations have not lost one lineament from the lapse of time.[44] Herodotus, "save in a picture," did not see the Phœnix, nor, though that would have been a trifle to its feats among the Hymenoptera, has natural selection yet brought it to the birth; but he saw and described the hippopotamus and the crocodile,[45] precisely as they will be seen, and very much as they will be portrayed, by this year's tourists to the Nile. If the moderns do not descant on the wonderful impunity enjoyed by the trochilus, on account of its enterprising services as an animal dentist in relieving the crocodile's jaws of leeches, it will be because their faith in the instinct-quelling virtues of natural selection is less lively than that of Herodotus or Mr. Darwin. The salmon still bounds over the river-barrier as when the Roman soldiers named it "the leaper," seen by them for the first time in the streams of Gaul. The gnat, whether or not in friendly warning, still stings the sleeping rustic as in Virgil's verse; the grasshopper chirps gaily as in Anacreon's song; "still clang the cranes, and soar aloft the eagles; still dance in air the summer-loving flies as in the days of Homer; and still the

polypus and sponge, and all the inhabitants of the sea, exhibit in the Mediterranean the peculiar properties noticed in them by Aristotle."[46] Nay, as if to fore-falsify the parallel suggested by Mr. Darwin and elaborated by his disciples, an appeal is taken from the fluctuations of language to the stabilities of nature; and classical orthoepy selects as umpire in its controversies the changeless vocalization of the sheep and the owl. And if this *miniature* antiquity be held of no account—though no just reasoner will so regard it—Geology will not refuse attesting glimpses through that mightier vista which she claims as her peculiar domain. She will cull us plants from our British flora, minute duplicates of those that must have crept hither from the Himalaya slopes ere the German Ocean barred the passage.[47] Or, a lesson on the intrinsic likelihood of ascensive development, by natural selection, or any other stimulant to progress, she will show us, in the province of microscopic life, diatoms of the Oolite that are diatoms to-day, and the infusoria of the Chalk still teeming in the Baltic.

26. Passing, however, from that "record" on the "imperfection" of which Mr. Darwin sophisticates with such small success, we cannot fail to be reminded that,

in any inquiry touching natural law and its working, vastness of *scale* is equivalent to immensity of duration. He who watches the Milky Way through a month of northern winter would gain no deeper conviction of the stability of the universe from a million years' survey of a solitary sun. If wheat be sown in one and the same year *simultaneously* over a hundred square miles of considerably varied area and nothing but wheat comes of it, the experiment is of the same value as a hundred *successive* experiments, over a single square mile, in as many successive years, would be. Now grant to Geology her hundred million years in time; the earth has twice a hundred million square miles of surface. Is the breadth of the life-experiment so transacting, magnified, at the least, by the whole depth of history,—and sometimes, as Agassiz has proved by the coral-builders of the Gulf of Florida, tenfold that depth,—to count for nothing? Mr. Darwin's admirable mastery of the resources of his native tongue scarcely yields him expressions strong enough to glorify the wealth of natural in contrast to the poverty of human selection.[48] And if there were indeed an agency in nature so endowed and commissioned as he endows this favourite child of his imagination, the contrast could not be overdrawn. Now

artificial selection enacts and exhausts its cycle of permitted change—goes, in homely phrase, "the length of its tether"—with entire docility and in a short period of time. Sir George Sebright undertakes "head and beak" in six years, and proffers any "feather" in three. What then may not be expected from the mighty counterpart power, at work unceasingly in earth and ocean; the enormous area, moreover, of the terraqueous globe being inter-multiplied with the millenniums of the historic past? And yet on this, the largest scale strictly accessible, there are confessedly no signs of specific change. All things continue as they were. A species may go out, but no species comes in. A species may die, but it never surrenders. The world of reason has made enormous strides: the world of instinct is as it was, learning nothing new and unlearning nothing old. So far as any perceptible alteration is concerned, natural selection, over this immense area, has been for so long a time asleep. Now it seems less unlikely that Mr. Darwin should have been looking for *the wrong sort of results* than that a power of such capacity, at work on such a scale, should have *no results to show.* Emphatically, on such a scale. "He bringeth forth grass for the cattle, and green herb for the service of men. . . . The

trees of the Lord also are full of sap, even the cedars of Libanus which He hath planted. . . . O Lord, how manifold are thy works! in wisdom hast Thou made them all: the earth is full of thy riches. So is the great and wide sea also, *wherein are things creeping innumerable*, both small and great beasts." [49] Such the play of vitality, three thousand years ago, over two hundred million square miles of surface; such, athwart that surface, the range to-day. Natural Selection is a mighty and a slumberless magician; and all things in earth and sea are pliant to her spell. She has built up some pithless algal into the cedar of Libanus. She has nursed the microscopic monad into the forest carnivora. And she is pursuing her course "unhasting, unresting," now, as at the beginning. Yet, across this area, and throughout this period, not a seaweed has approximated to the meanest fern, not an earthworm been promoted to the grade of insect! If this basis of induction be too narrow to sustain a doctrine as to the methods and capabilities of nature under the influence of mere law, it were insanity to hope for a broader. Scale has a tongue as well as Time. And "the vast variety," we may be very sure, "of the organized world speaks not of the operation of *unvarying laws*, that represent, in their uni-

formity of result, the unchangeableness of the Divinity, but of *creative acts* that exemplify the infinity of His resources." [50]

27. With the idea of *design*, stamped on animal structures and instincts, Mr. Darwin, by the necessity of his hypothesis, is at open war. He admits in the frankest way that a belief in Final Causes, or, as Cuvier preferred calling them, the Conditions of Existence, would be fatal to his scheme. A prospect-glass or a forceps is an *instrument;* they have each a final cause; that is, they were each made and adjusted for a certain use. The use of the prospect-glass is to assist the eye: the use of the forceps is to assist the hand. The prospect-glass was made the better to see; the forceps the better to grasp. *The use did not make* these instruments; they were each *made for the use*—which use was foreseen and premeditated in the mind of the maker of them. We say of each of them without a shadow of hesitation: IF THIS HAD NOT FIRST BEEN A THOUGHT, IT COULD NEVER HAVE BEEN A THING. Now, is the Eye or the Hand an instrument adjusted to a certain use, and thus revealing an antecedent purpose in the Creative Mind, or is it not? Can we account for either except by saying that it was thought out before it was wrought

out ; that it was a concept in mind ere it could possibly appear as a configuration in matter ; that before it became *a fact in nature* it must needs have been *a thought in God ?* According to Mr. Darwin, we can and ought. Human mind made the prospect-glass, but no mind presided over the structure of the eye. Such mind is dispensed with by natural selection : a sensitive nerve, whence derived is not said, will in millions of ages *select itself* into an eye ! The same solution will of course suffice elsewhere. "The new-born kangaroo is an inch in length, naked, blind, with very rudimental limbs and tail : in one which I examined the morning after the birth, I could discern no act of sucking : it hung, like a germ, from the end of the long nipple, and seemed unable to draw sustenance therefrom by its own efforts. The mother accordingly is provided with a peculiar adaptation of a muscle (cremaster) to the mammary gland, by which she can inject the milk from the nipple into the mouth of the pendulous embryo. Were the larynx of the little creature like that of the parent, the milk might, probably would, enter the windpipe and cause suffocation : but the fœtal larynx is cone-shaped, with the opening at the apex, which projects, as in the whale-tribe, into the back aperture of the nostrils, where

it is closely embraced by the muscles of the 'soft palate.' The air-passage is thus completely separated from the fauces, and the injected milk passes in a divided stream, on either side the base of the larynx, into the œsophagus. These correlated modifications of maternal and fœtal structures, designed with especial reference to the peculiar conditions of both mother and offspring, afford, as it seems to me, *irrefragable evidence of Creative foresight.*"[51] . . . "The parts of this apparatus cannot have produced one another; one part is in the mother, another part in the young one; without their harmony they could not be effective; but nothing except design can operate to make them harmonious. They are *intended* to work together; and we cannot resist the conviction of this intention when the facts first come before us."[52] The significance of such facts, and the legitimacy of such comments,* which extend in their principle over the whole field of organization, may be safely left, Mr. Darwin's blindness to them notwithstanding, to the common sense of mankind. The case is too strong to be explained away. Nature is full of plan, and yet she plans not: she is only plastic to a plan. That plan speaks self-attestingly to all healthy understandings. It has its warp indeed as well as its

*Appendix A.

woof. The exquisite variety of creative adjustments reposes on a basis of fundamental order: exhaustless specialities of adaptation are engrafted on a pervasive unity of type. But Morphology and Teleology—the recognition of a general Model and of specialized Modes—can never be justly conceived as at schism till concessions to symmetry in works of human art are pronounced incompatible with a regard to use, or, again, till the skill of the consummate musician is held to be impeached by the simplicity of the strings.[53] Morphology, rightly viewed, is not the negation, but one grand phase of the revelation of plan. Teleology is the other. It has been by following the lamp of Final Cause, and obeying her beckoning hand, that the masters of anatomical and physiological science, from Galen to Cuvier, and from Harvey to Owen, have been guided to their splendid discoveries.[54] The method that is thus scientifically fruitful is, however, the great stumbling-block to all schemes of development, since it is the mainstay and bulwark of Natural Theology. It is impossible to ask, *For what?* without further asking, *From Whom?* The measure of the confidence with which Science assumes *a use* is that of the confidence with which Religion affirms *an Author*. "He that planted the ear,

shall He not hear? Or He that made the eye, shall He not see?" Not only has this argument been esteemed invulnerable by the most masculine reasoners among Christian divines, as Barrow and Paley, Chalmers and Whewell: it has carried conviction, from the time of Socrates to that of Cuvier, throughout the foremost minds of the human race, and found almost its sole antagonists among spinners of cobwebs and dreamers of dreams.* Nowhere is the hallucination of perverted genius more apparent than in the insane vehemence with which Lucretius warns his reader against the imminent danger of being tempted to suppose that eyes were made to see, or feet and legs to walk. Mr. Darwin's more subdued though similar warning will meet, as it merits, a similar fate. The prints of Divine forethought, and the convictions they engender, are scattered over the face of universal nature, and ploughed into the very subsoil of the human mind.

28. On the field of Final Causes, then, with full feeling of the stake yet no fear for the issue, Natural Theology takes her stand, and offers battle to Natural Selection. Her strength is concentrated, though not exhausted, on two main positions. She appeals to the phenomena of animal *framework;* not only as exem-

* Appendix B.

plified in single organs, however wonderful, but in the co-adaptations and inter-dependence of entire organisms. Is human purpose, for instance, stamped on the destination of a balloon—unmistakeable from the conjunction of its texture with its contents; and shall we see no sign of higher purpose in the unique structure of a bird, with its incomparably more complicated apparatus for flight; the plumage combining so perfectly the conditions of warmth, lightness, and locomotive power, and the requisite buoyancy being subserved, not only by the inflation of air-cavities auxiliary to the lungs, but by the quill-like hollowing of the very bones?[55] Shall we say that Thought underlies a silk-bag, gaseously distended, while yet the marvellous living mechanism, as incapable as the other of self-production, but of which the other is so poor and bald a copy, implies no prevision of use? Nay; "for by the greatness and beauty of the creatures, proportionably the Maker of them is seen."[56] But, besides the fabric, though in close sympathy and concert with the fabric, Natural Theology rests her argument on the *instincts* of animals.* God *in*structs as well as *con*structs. Recondite problems which have stood the siege of meditation ever since geometers began to think, and which Isaac Newton

* Appendix C.

left partially unsolved, surrender at last, and *Eureka* is cried over a very advent of illumination ; only, however, that the victorious human intellect may peruse at its leisure the anticipation of the achievement, and the faultless transcript of the solution, in the hive-bee's cell.* It would of course be as reasonable to confound the brush with the painter, or the helm with the steersman, or the geometer's pen with the process of calculation it records, as this result with conscious forethought in the insect. If certain structures refer us of necessity to a Divine Architect, such instincts point as peremptorily to a Divine Implanter, and betoken the presence of a plenary inspiration. Not less clearly is the Bird a living balloon, than the Bee is an "animated tool."[57] This impression is not of yesterday. An old observer of bees has given voice to it in undying verse :

> His quidam signis, atque hæc exempla secuti,
> Esse apibus partem divinæ mentis et haustus
> Ætherios dixere ; Deum namque ire per omnes
> Terrasque, tractusque maris, cœlumque profundum ;
> Hinc pecudes, armenta, viros, genus omne ferarum,
> Quemque sibi tenues nascentem arcessere vitas.[58]

29. If we except a passing cavil at the imperfect knowledge of optics displayed in the mechanism of the

* Appendix D.

eye,* Mr. Darwin can scarcely be said to have touched the evidence for design deduced from the felicities of fabric, and deep-lying adjustments, so profusely exemplified throughout the animal kingdom. He tells us indeed how the pigeon's feather may be varied, but not how the pigeon came to be feather-clad at all. He leaves us quite in the dark also as to the mode in which natural selection sets to work in the multiplying of air-sacs, or in the boring of bones, to increase the facilities for flotation and flight. But he devotes a large portion of a chapter on Instinct, otherwise extremely graceful and interesting, to a hypothetical exposition of the processes by which the common hive-bee, *Apis mellifica, might* have distanced her less skilful kindred *Melipona* and *Bombus;* and how the wonderful phenomena of sexual suppression and vicarious labour *might* have arisen among the social insects of the bee and ant tribes generally. No one, since Touchstone's time, has set such store on the virtues, or so taxed the capacities of an *If.* A certain abstract theorem conceded, *if* Bombus or Melipona could be brought to put that theorem in practice, one huge stumbling-block would be removed from Mr. Darwin's speculative path. But this is the hitch. It is as much out of the question for

* Appendix E.

Bombus or Melipona, not being a man, to see with Mr. Darwin's eyes, as it would be for Mr. Darwin, not being a bee, to work with Melipona's tools. Slight deflexions of habit, artificially provoked, in the more highly endowed insect, do not furnish the smallest presumption of the genesis of new endowments in its inferior sisterhood. "It may easily be *supposed*," in these researches, is but a sorry substitute for, "It has actually been *observed*." The true tokens of consummate geometrical prescience can never be simulated by tentative effort. Had Mr. Darwin lived two thousand years ago, his ceral experiments might have furnished a target for the shafts of Aristophanes ;[59] but, indifferent alike to savant and satirist, Melipona was then building her cells no better, and Mellifica no worse.[60] Those explanations of the mystery of cell-making which really explain nothing are, however, moderation itself to the inimitable though unconscious legerdemain which converts an unanswerable and unblunted objection to our author's favourite solvent, drawn from the phenomena of insect sterility and caste, into the occasion of a panegyric on its power. It is his business to prove that natural selection *has done* certain wonderful things : See, he virtually says, what wonderful things, far beyond

my own expectation, natural selection *can do.*[61] A more flagrant intrusion of unpruned fancy into a domain sacred to the severities of observation can scarcely be conceived. The social insects, like those lower in the scale, must have started, on Mr. Darwin's view, as ordinary male and female, with a common share of individual labour; on a par, in this respect, with a flock of geese, or a herd of cattle, or a community of mankind. Now let any breeder of cattle consider through what agencies a variety could be attained, of which only one birth in five should be a bull or a cow, the other four being natural neuters, devoted subjects of their perfect sister, but sworn foes of her spouse. It is an aptitude precisely analogous to this that has produced, we are asked to believe, the economy of the bee-hive. Or let any transatlantic admirer of the "domestic institution" of *Formica rufescens,* turn over in his mind the means by which every third man-child born on his estate should be ten times the size of the rest of the family; or each alternate female be fitted for a nurse while forbidden to be a mother; and he will have the measure of the intrinsic likelihood of the Darwinian doctrine, in its bearing on that insect and its confederates. It were idle to enlarge. There are worthier lessons to

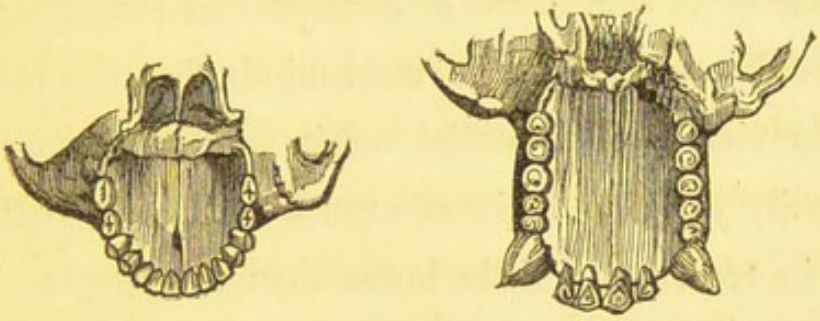
be gleaned from the world of instinct than such as affront all legitimate analogy, and gratuitously dissociate the marvels of nature from their only true solvent, the ordination of God.

> Who made the spider parallels design,
> Sure as Demoivre, without rule or line?
> Who bid the stork, Columbus-like, explore
> Heavens not his own, and worlds unknown before?
> Who calls the councils, states the certain day,
> Who forms the phalanx, and who points the way?
> God, *in the nature of each being, founds*
> *Its proper bliss, and sets its proper bounds.*
> . . . . .
> Thy arts of building from the bee receive,
> Learn of the mole to plough, the worm to weave;
> Learn of the little nautilus to sail,
> Spread the thin oar, and catch the driving gale:
> Here, too, all forms of social union find,
> And hence let Reason, late, instruct mankind:
> Here subterranean works and cities see,
> There towns aerial on the waving tree:
> Learn each small people's genius, policies,
> The ant's republic and the realm of bees.[62]

30. Nothing then appears more certain from the examination of nature than that each creature has an orbit assigned to it, the attempted transgression of which would be, not the improvement of the species, but the destruction of the individual. A frog trying to select

itself into an ox would not thereby become bovine: it would simply burst. How strange, on Mr. Darwin's scheme, that such aspirings are confined to the region of fable, and that no animal has ever been seen on the road which such countless myriads must have travelled between the old species and the new! Why has no creature ever been caught *in transitu?* The pelican feeding its young from its bosom, however beautiful in ecclesiastical symbolism, is unknown to all but legendary lore. On the principle of natural selection, as has been pertinently observed, a protracted exercise of the pugnacious propensity ought to improve the weapons of attack; and yet the antlers of the red-deer now alive in Windsor Forest are no whit better than those found in the "submerged forest-lands which date back long before the beginning of our English history."[63] After an exposure to modifying influences of the most powerful kind, including the companionship of man, the dog, as if to show that no such influences can make a creature other substantially than the Maker made it, is what it was in the days of the Pharaohs. The anatomical approach to the human species, which reaches its permitted maximum in the higher quadrumana, was as evident to Ennius[64] as to Mr. Rogers or Mr. Darwin.

But then, as now, (not to anticipate the inquest for a more profound partition) the four "graspers" of *Pithecus* and *Troglodytes*, the most anthropoid of apes, were very different instruments from the true hand and foot, as specialized and distributed in man.[65] There is also a world of meaning in the enormous development of the canine tooth in the male gorilla or orang: all the more clearly from their being frugivores, it is a weapon which



Human and Ape palates:
Showing the great canines in the latter (Orang).

marks the brute.[66] If we consider, besides, the climatic limitations, so rigidly imposed on the quadrumana, derivation from the dog will seem as credible as from the ape. The dog, like his master, is a citizen of the world, and can be acclimatised everywhere. But the ape is chained to the tropics;[67] and could no more diffuse his offspring throughout the Temperate latitudes than man himself could colonize the peaks of the Alps, or found flourishing cities at the North Pole.

31. Tried then by the appropriate tests, Mr. Darwin's scheme is found wanting. To a fair hearing he is amply entitled. True, his doctrine is fatal—there is no use concealing it—to what has hitherto been revered as Divine Revelation: Man, when he dies, has as much to fear or to hope for as his kinsman and congener the gorilla, and no more. That is consequence the first. The speculation, moreover, is such as may excuse, on the face of it, a measure of distrust and shrinking; for the creed would change in most minds the code of duty, and conviction of a bestial origin and fate would not ordinarily yield the fruits of even a feeble and flickering faith in rank but a little lower than the angels. That is consequence the second. Mr. Darwin does not deduce these consequences: with instinctive loyalty to a better culture, he studiously abstains from drawing them, and even, indirectly, deprecates their being drawn.[68] Nevertheless he has touched to the quick the problem pressing through all time on all souls for solution: "What is life, and what ought I to live for? Is man a spiritual nature, surviving the grave, or simply the chief animal, and death the last of him?" The question at issue bears all the burden of the chasm that parts the creed of Lucretius from that of St. Paul. "Lying on the

infinite bosom of nature, the Greek was yet unsatisfied. . . . Had you asked his highest wish, he would have replied, 'This world, if it would only last, I ask no more.' . . . Its revels, its dances, its races, its academic groves, these were blessedness ; and the Greek's hell was death." [69] Would the case be otherwise with a modern to whom a future life had become a brain-sick phantom, and the Deity practically undistinguishable from the aggregate of physical laws? Or if otherwise with the very few whom the accidents of a refined temperament and a noble culture kept a class by themselves, would it rest with this or the other lettered recluse to lay reins on the fierce logic of the multitude? The creed that man is ape-born, speaking generally, where it made a disciple would not miss an interpreter. Did it ever pass from the brain of imaginative savans into the heart and belief of a people, no shrinking on the part of its authors could stay its mission—could prevent its stamping a sordid utilitarianism as the sole wisdom of life, and *Sauve qui peut* as the whole duty of man ; lending ruthless oppression its ready salvo, and successful chicane its absolving gospel. But this is a digression. Consequences, whether agreeable or disagreeable, have no legitimate voice, it

must be carefully borne in mind, in the determining of scientific fact. No consequences will make that which is true false, or that which is false true. If man is a transmuted ape, no brilliancy of ridicule, or felicity of sarcasm, will upset the proof, or dissolve the pedigree. Mr. Darwin did not make nature; he only interprets it; and so he does not *mis*interpret, no fault can be found, however startling or saddening the facts may be. "What is actually true it is always most desirable to know, whatever consequences may arise from its admission;" [70] and truth is not the contortion of things by thought, but the conformity of thought with things. Let the truth then be reached, though the heavens fall; only, when it is a case of the heavens falling, be we very sure it is truth that brings them down. Do then the observed or recorded phenomena of species supply any solid groundwork for Mr. Darwin's speculation? Does it decipher aright the function of the struggle for subsistence? Does it allow due force to the laws of limitation and equilibrium, so critically coinciding with the pervading rule of nature as to animal sterility and productiveness? Does it account for the predetermined life-cycle in different species; the "septuma ætas" or the threescore and ten? Has it any animal to show,

lifted by either natural or artificial means out of its own sphere? Does it tally with the testimony of the rocks? Does it take account of the equivalence of scale to time? Does it vanquish the infinitely ramified proof of design in the structures and instincts of animals; and succeed in converting creative *endowments* into fortuitous *acquirements?* Can we descry with clearness in the vista of the future, by putting on the spectacles of natural selection, here a race of superhuman men, and there a race of super-simian apes? Have we lighted on the true apology for the basest shapes of historical superstition when we discover that the Egyptian monkey-worship[71] was an innocent memorial of —— ancestors? Are Homer, and Plato, and Pascal, and Shakspeare, to be looked back on and looked down on by the coming masters of the earth, as *we* look back on the mammoth or the mastodon; and shall it be the chosen pastime of the sages of the future to

> Admire such wisdom in so mean a shape,
> And show a Newton as we show an ape?

Or, conversely, must we accept it, as matter of unerring prediction, that, supposing the scene cleared of their human competitors, only time is required for the dawning of a new and splendid civilization, guaranteed by

the action of infallible laws, and the hope-inspiring aptitudes of the gorilla and the orang? All products of art, language, science—the city, the minster, the university; the steam-ship, the telegraph, the printing-press; the sculpture lining the walls of the British Museum, the thought garnered in a million volumes beneath its dome—all this latent in the chimpanzee, *potentially restorable* from the baboon! Strike out all moral concern from the questions: the verdict of the Scientific Reason must surely nevertheless be, No.

32. Mr. Darwin himself reels and recoils in presence of these enormous incredibilities. But he reassures himself in some such fashion as this. My choice is between two alternatives. As a scholar of Bacon and Newton, I desiderate a *vera causa* for living things. Natural selection is such; creative agency is not. The one may be *improbable:* I own it is loaded with immense embarrassments, some of which I cannot even touch, far less remove: but the other is altogether *chimerical.* Would you really have me believe that "at innumerable periods in the earth's history, certain elemental atoms have been commanded suddenly to flash into living tissues."[72]

33. Darwinianism, like earlier schemes of development, is born of a difficulty; and this is that difficulty,

never more clearly or frankly put than in these few words. Pantheism is here packed into a nutshell: the seen is the measure of the possible; what this or the other man can conceive is the limit of what Deity can do! "Flash intelligence in a second across the Atlantic!" how confidently, some twenty years ago, the mass of civilized mankind, in the measurement of the power *of a fellow-creature,* would have poured scorn on the mention of such a project! There are regions in which reticence is still more prudent, and temerity still more rash. Mr. Darwin has been sitting at wise men's feet; but he has failed to drink in the spirit of their teaching. Bacon, for instance, would have counselled him that it is better to rest in ignorance of one order of facts than to strain after a spurious knowledge by the distortion of another. Bacon would have warned him that the opposing a metaphysical perplexity to the witness of nature, and the torturing that witness into a means of solution, was disloyalty to the lessons of the inductive philosophy. Bacon, and not less sensitively Newton, would have shrunk from the implied antithesis which dethrones from the rank of Verified Cause the *Causa causarum* Himself, and passes by the Author of the Cosmos as a spectre of the brain. "I had rather believe all the

fables in the Legend, and the Talmud, and the Alcoran, than that this universal frame is without a Mind. . . . It is true that a little philosophy inclineth man's mind to atheism, but depth in philosophy bringeth men's minds about to religion; for while the mind of man looketh upon second causes scattered, it may sometimes rest in them, and go no farther; but when it beholdeth the chain of them confederate, and linked together, it must needs fly to Providence and Deity."[73] . . . "The main business of natural philosophy is to argue from phenomena without feigning hypotheses, and to deduce causes from effects, till we come to the First Cause, which is certainly not mechanical."[74]

34. In shutting out the Creator, then, from direct or conscious causative agency in the Origin of Species, and contrasting ordinary causes as *veræ* with the chimerical cause, GOD, the champions of transmutation are not fighting in the Baconian ranks, nor entitled to the shelter of the Baconian shield. Some things we know, and some we know not; but, if Bacon be our guide, we shall never contort the conquests of our knowledge in order to assuage the cravings of our ignorance. Into the workshop—the *officina*—of Deity we are not permitted to pry. Wisdom was with Him in the begin-

ning, but *we* were not. Against us that laboratory, in which He wielded the forces of matter, and presided over the chemistry of incipient life, presents never-opening doors. What the phenomena impose is the reference of their origin, not to a self-evolving capacity, but to a Creative Intelligence. How that Intelligence wrought, is a problem with which the foremost knowledge of our time, in the absence of the appropriate data, declines to grapple.[75] True science, when it does not see, is not forward to speak. Enough that, to all spiritual intents and purposes, the problem is of only secondary interest. Creative Will might use, or might dispense with, pre-existent receptacles and channels of vitality; but each new form, under either supposition, would be directly due, not to natural processes, but to "the finger of God." It may be that, in the less signal steps of the upward procession, the Creator employed the earlier structure as the *nidus* or *matrix* of the later; as, for instance, in the variations of closely allied forms, if these be truly specific, throughout the Chalk or the Lias. But the grand *typical* ascensions best accord with the hypothesis, not only of creation *proper*, which this still would be, but also of creation *apart*. In the oldest of all "Origins" of Species, man is drawn from

the dust, with no ministerial substructure, and no preparatory scaffolding, responsive to the moulding will of One to Whom nothing is impossible, and Who measures not His power by our puny perplexities. In the origin so shadowed, amidst the shining light of nature as to the divinity of the fact, and the deep darkness of nature as to the choice of the method, we may still be content to believe.

35. If Mr. Darwin is perplexed, however, let him be *consistent in his perplexity.* The true question at issue is, Shall we account for the universe, and its vital phenomena, with God, or without Him? In instructive closeness of context to the famous challenge to show how elemental atoms could "flash into living tissues," Mr. Darwin speaks, as if the exploded lessons of Genesis were still lingering in his mind, of that solitary form of far primordial being into which "life was first breathed by the Creator."[76] It seems, then, that *this* achievement, this unique "flashing" from atomic lifelessness into organic life, was not *ultra vires* of the Almighty. Can our author acquaint us further what an atom *is?* Or how many atoms on this occasion were called into play? Or at what point of their muster, in more exuberant array and more elaborate combinations, the power of

the Highest must have shrunk checkmated from the control of them? Can anything within the compass of human understanding be more self-evident than that no man is free to part the problem involved in Origin of Species from that involved in Origin of Life? If nature cannot initiate Life, why must she be set to initiate Species? If the Creator may not be postulated at the birthday of Species, why must He be postulated at the birthday of Life? You require a Divine power for Life: "dead matter would be for ever dead if *He* did not quicken it:" why not refer Species to that same power? Either this is a mere *façon de parler*, which gives the name "Creator" to Natural Law as a passing sop to vulgar prejudice, unripe as yet for the lesson that electricity will account for aboriginal life, as the ape for intellectual man, and that if nature can give us a man from a *protozöön* she may give us a *protozöön* out of nothing;* or else Mr. Darwin concedes his whole case. His scheme is not forced on him by observation of nature; but he forces it on nature in obedience to a metaphysical difficulty. And to what does that difficulty amount? Is it rational to ascribe a mode of action to the Creator in the imaginary strata beneath Siluria which it is irrational to connect with the Oolite or the

* Appendix F.

Pleistocene? If the infinity of worlds is not a desert, God moreover must have *set life a-going* there. Was the *vera causa* competent to that task too feeble to marshal the terrestrial sequence of species? Or is it consonant with the Creator's dignity to "breathe life" into a monad, but beneath His majesty to breathe life into a man?

36. There is nothing so regrettable in Mr. Darwin's book as his paltering with this momentous issue. Why seek to establish an insincere and flimsy truce between such schemes of the human origin and religion? It reads like an unworthy mockery of faith and hope to be offered, even with the recommendation of "celebrated divines," the "ennobling" assurance of descent from a fungus in lieu of the Christian revelation of the Father and Futurity.[77] "Adam was the son of God." Nay, in such case, in other than the olden meaning, he must "say to Corruption, Thou art my father, and to the worm, Thou art my mother and my sister."

37. Happily, we may meet Mr. Darwin's scheme irrespective of its bearings on our hopes or our wishes, our holiest feelings or our worthiest fears. To Natural Selection, with unabated confidence, we may oppose the old belief in CREATIVE ELECTION; nay, with confidence

augmented in the ratio of that plenitude to which the proof of Divine forethought in the graduation of animals has now attained. On the earliest page of *Origines Sacræ*, we read that the Creator brought to Adam every living creature to be named; "and whatsoever he called them, that was the name thereof." To the mind of a child this will call up the picture of a sort of animal review; a muster of quadrupeds and other creatures innumerable defiling in procession before the first father of our race, and receiving each a changeless name on the spot to go down to its offspring for ever. A worthier reading of the narrative, with due allowance for the partial veil of parable, will perhaps commend itself, however, to a more reflective age. It will be seen that Adam is here portrayed as the first holder and representative of that *Adamic faculty* in virtue of which Man stands forth the constituted Critic of Creation; sole earthly decipherer of the Almighty's purpose, and recorder of the wonders of His hand. Small likelihood, it may be owned, that a range of knowledge, the inheritance of patient centuries, was bestowed by miracle on our first parent to perish with him in his grave. But what a field for devout gratitude opens up on the perception that "Adam" here personifies the aggregate pre-

rogative of universal human thought; the unborn genius of that illustrious succession to whom Nature has surrendered her secrets and told out her oracles, till the bewildering chaos of the starry movements above, and the threadless labyrinth of living forms below, have each resolved themselves into a splendid harmony of Creative wisdom and beneficent design. When, after long years of racking and unrewarding toil, Kepler at last unlocked the problem of the heavens, his emotion, it is said, found memorable vent—"O God, I think Thy thoughts after Thee!" Many centuries before, the geometers of ancient Greece had reasoned on the properties of the figures attained by the various cuttings of the cone. By the discovery of the modern, the stars in their courses shone out a celestial diagram of those self-same curves; the veil was lifted from the face of space; and lo! the earth and her sisters swam in those very figures through the deep of the sky. The sun was environed by so many tracings of the Conic Sections, and Kepler saw it was so, and "thought God's thoughts after Him." In this his offspring, of a truth, thus binding into a unity planet, comet, and satellite, was Adam naming the creatures. He was naming them when Solomon studied vegetation, "from the cedar of

Lebanon to the hyssop on the wall." He was naming them when the penetrating genius of Aristotle first gave system to natural history. He was naming the creatures still in Linnæus and Cuvier. He is naming them to this hour in the labours of Richard Owen.

38. Indeed in the sense of their being accurately marshalled, compared, and ordinated, they are now almost *named*. The English explorer has placed the copestone on that fabric of classification of which the Stagirite traced the outlines and laid the foundations,[78] and the Swede and the Frenchman built the walls.[79]

An undevout *anatomist* is mad.

So felt Galen when he described his work as a "religious hymn in honour of the Creator." The most exact knowledge of the nineteenth century has not parted company from the sentiment. Nay, advancing illumination has but brightened the proof of Divine Forethought, not only as setting its print on special adaptations, but as stamping itself on the symmetry of the whole system of existence.

39. All Comparative Anatomy may be said to be tending towards the recognition and extrication of three supreme values, in the grouping of animals and the

graduation of life, past as well as present—the BACK-BONE, the BREAST, and the BRAIN. To appreciate these values aright is to read truly the "Vestiges of Creation;" because it is to trace the unfolding plan and to follow the measured "Footprints of the Creator." It is not in astronomy alone that the mind of man has been enabled to "think God's thoughts after Him." And the result of those researches which have been thus rewarded, in the study of animal life and its assigned prerogatives, may be exhibited, if I mistake not, as a *Contracting Leet.* The key to the significance of which is not, and cannot be, Selective Development, but must be, and is, Elective Design. (*Page* 89.)

40. The first leet, in the ascending order, takes note of all animals as Vertebrates or Sub-vertebrates: for every individual organism endowed with a backbone, there are countless millions without it.[80] Hence this first or exterior leet leaves a master-group, palpably supreme in framework and ground-plan, over three other groups—the Articulate, the Convolute,[81] and the Radiate—between which and the master-group the Barrier of Backbone stands impassable; at least till it is explained how a butterfly could become a bird, or a snail a serpent, or a star-fish acquire the skeleton of the

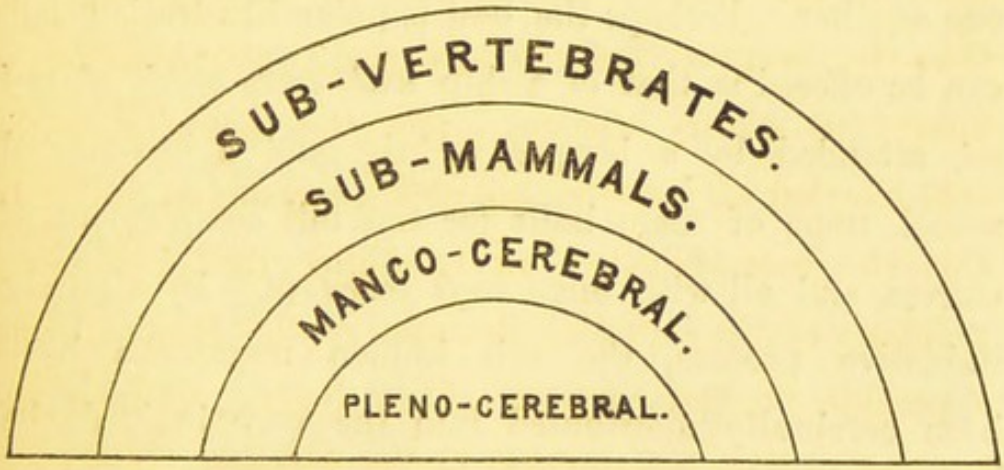
ZONE OF PROTOZOA.	SUB-EXOGENS.				
		EXOGENS.			
		GYMNOGENS.	ARCH-EXOGENS.		VEGETABLE KINGDOM.
		PROGRESS IN (Joint Firs.) REPRODUCTIVE (Pine and Yew tribes.) ORGANIZATION (Cycads.)	POLYPETALOUS. MONOPETALOUS. APETALOUS.		
	ENDOGENS. ACROGENS. THALLOGENS.				
		SUB-MAMMALS.	MANCO-CEREB.	PLENO-CEREB.	ANIMAL KINGDOM.
			MAMMALS.		
		WARM-BLOODED AIR-BREATHERS (Birds.) COLD-BLOODED AIR-BREATHERS (Reptiles.) COLD-BLOODED WATER-BREATHERS (Fishes.)	WAVE-BRAINED. SMOOTH-BRAINED. LOOSE-BRAINED.	MAN.	
	ARTICULATES OR CIRCUMSECTS. MOLLUSKS OR CONVOLUTES. RADIATES OR GLOBULATES.				
	SUB-VERTEBRATES.	VERTEBRATES.			

salmon or the shark. It is like the going forth of a Divine decree : " One shall be taken, and three shall be left."

41. The second leet, Sub-vertebrates out of view, takes account of Vertebrates themselves as Mammals or Sub-mammals. Among the elect it makes an inner election. Besides the Backbone it exacts the Breast ; shedding off, as before, three well-marked groups subordinate to the master-group of Mammals or Sucklers. Which breastless tribes are Birds, Reptiles, and Fishes ; holding high, low, and medium rank among themselves, not so much on the principle of skeleton, or its specialized offshoots, as on that of characters which are correlated to the development of care for their young. In this the lungless and cold-blooded water-breather is almost or wholly wanting ; and the instincts of the cold-blooded air-breather are also sluggish and dull. In this the warm-blooded air-breathing Bird becomes a prophecy of the unfailing devotion of the Mammal, and a parable for the Supreme Love Itself. " Under the shadow of Thy wings shall be my refuge." . . . "How often would I have gathered thy children together, as a hen gathereth her brood under her wings ! " Still the Mammal, by its endowment of the fostering

bosom, stands elect, aloft, and apart—Bird, Reptile, Fish, far beneath in the scale; and till it is shown how an animal that never *got* suck stumbled on the capacity of *giving* what was never given it, the Breast will stand, against all dreams of development, companion-barrier to the Backbone. Again is heard the elective edict: "One shall be taken, and three shall be left."

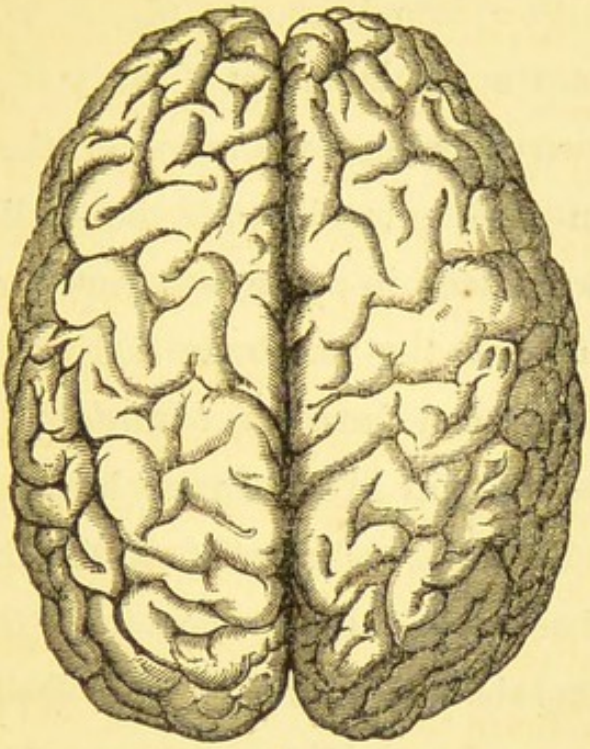
42. Third, last, innermost leet: note has to be taken among the Mammalia themselves, from the Marsupials to Man, of the presence or absence of one testing character, and that the chief—the Perfect Brain. This is found in one creature, occupying, as it were, the inner ring and core of the concentric circles of vitality, and in



one alone. In the lowest variety of man it is present—present in the Negro or the Bushman as in the civilized European; and absent in *all below* man—absent in the

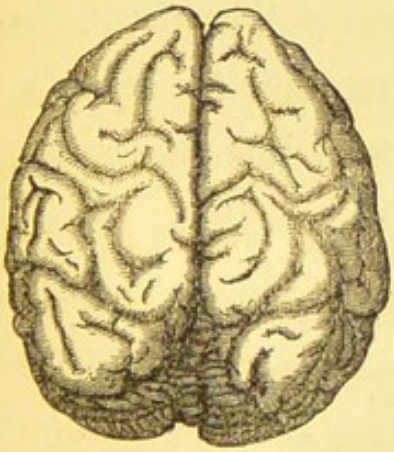
ape or the elephant as truly as in the kangaroo or the duckmole. To *all* men the pleno-cerebral type is *common:* to *man,* as such, it is *peculiar.* And till we hear of some simian tribe which speculates on its own origin, or discusses its own place in the scale of being, we shall be safe in opposing the Human Brain, with its sign in language, culture, capacity of progress, as barrier the third to Mr. Darwin's scheme. In proportion to the delicacy of the apparatus, and the value represented by its smallest variations, is the difficulty of laying the needle-point on those characters of structure which part the Perfect Brain from the Imperfect, and the grades of imperfection, among the manco-cerebral mammalia, from one another. Perhaps the best popular illustration that can be offered is that of a ship *with every stitch of sail set,* attended by a barque, a brig, and a one-masted vessel, none of them built for the full complement of canvas, and all with huge *reefs taken in.* By a purely inductive process, the sub-human mammalia have been cerebrally distributed into the wave-brained, the smooth-brained, and the loose-brained,[82] represented by the ape, the beaver, and the kangaroo; with a result, so far as the two departments of science are comparable, like that of the application of Kepler's laws to the

PLENO-CEREBRAL.



Archencephala : Negro.

MANCO-CEREBRAL.



Gyrencephala :
Chimpanzee.

Lissencephala :
Beaver.

Lyencephala :
Opossum.

(Scale, One-third natural size.)

planetary motions: the subjects of the classification fall, for the first time, into their true places—a mob of animals becomes a regular army. What it concerns us here to observe is the consonance of the division so obtained on other grounds with the earlier stages of Creative workmanship; through inferior sustaining structures *towards* the vertebrate skeleton, through attempered fluids and functions, *towards* the mammalian bond. And thus, as in the former leets, are the triple tribe of under-brains walled off from the Brain of Man. A third time there falls a voice from the Excellent Glory: "One shall be taken, and three shall be left."

43. POWER, LOVE, WISDOM; are not these words written on this trinal ascent? And, if so, has not God inlaid a revelation of his very nature in the graduation of his works? Has He not engraved this *Gloria Patri* on the old tables of stone; and mirrored the majesty of that Divine Name we worship * in this procession of styles in the animal architecture?

* Blessed and Holy Three!
Glorious Trinity!
WISDOM, LOVE, MIGHT!
Boundless as ocean-tide,
Rolling in fullest pride,
O'er the world far and wide
Let there be light!—*Marriot's Hymn.*

44. Below the fish, how comparatively *powerless* all creatures are! The primates of sub-vertebrate nature are the ant and the bee. Most mollusks are anchored to one spot for life, and the bulkiest of crustaceans *(page* 50), shorn of other locomotion, could only crawl in shallow waters among his rocks and sands. The advent of the backbone is the advent of animal power—the type of an all-pervading and resistless energy. To its possessors it is literally a "pillar of strength." The wing of the eagle, the jaw of the crocodile, the spring of the tiger, the teeth of the shark, the terrible coil of the boa constrictor [83]—the backbone is the basis of them all.

45. Below the mammal, again, how *loveless,* by comparison, is the world of life! As we approach the mammalian frontier, it is true, the dawn of the new endowment is distinctly seen; just as a great city shows itself miles and miles away. But even in the bird, and far more in the insect,[84] the tie to offspring is justly construed as mechanical obedience to impulse rather than as individualized and intelligent affection. There are no sub-mammalian mothers: animals below the line are parents or producers only.[85] The crossing of that line is a great work of Deity. God creates a new thing

in the earth when He hangs the nursling on the breast of its mother, and bids the two be as one. Till now there was but a simulating instinct; but this is love. Along with the prerogative of the nurturing bosom, there everywhere start up, in land and sea, the most touching examples of brute devotion and of passionate maternity.

46. Deep calleth unto deep, and the cry is still *Excelsior!* Nature is a hierarchy, and the head is Man. Mind, language, civilization, worship—the will to determine, the tongue to speak, the hand to do—these, in their boundless purport, are all awanting till the Creator plants upon the scene the solitary owner of the Perfect Brain. Named in one word, all these are *wisdom;* and Man, "thinker of God's thoughts after Him," is, among uncounted myriads of lower existences, on this earth the Only Wise. Of this superiority, the human brain is the badge. Attempts have been made to abate, or even efface its significance: it has been argued that the differences in cerebral structure between man and the higher quadrumana are anatomically slight; that the lower varieties of the human brain form a link to the ape brain; and that the brain-differences of a European, a Negro, an orang, and a lemur, might be serially re-

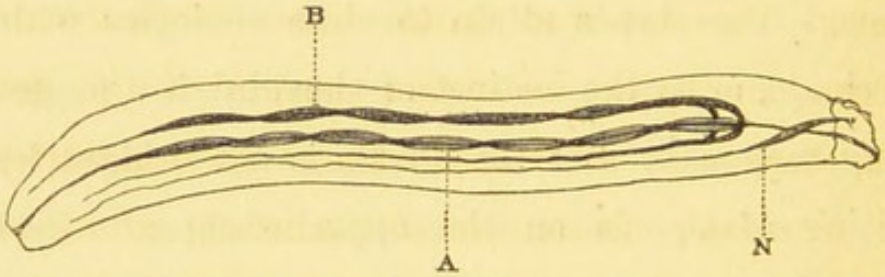
presented by the letters *a*, *b*, *c*, *d*, as a mere matter of degree and not of kind.[86] To this I answer, all healthy human brains are structurally perfect; whereas the highest brute-brains are structurally imperfect. The human brain is pleno-cerebral; all other brains are manco-cerebral. The former, in its least cultivated manifestations, retains the latent franchise of progressive reason; the latter exhibit the rigid circumscription of unprogressive instinct. Any human infant is susceptible of human culture; no brute is. This is a difference strictly immeasurable. Bear with a local illustration. On the Aberdeenshire coast, and at the most easterly point of Scotland, are two conspicuous buildings within a stone-cast of each other. In height and general architecture they are much alike; both, moreover, possess an internal staircase; and there the resemblance ends. One is seen by day, when to see it is useless, far more conspicuously than the other; but it ceases to be visible on the wild winter-night, when its neighbour is flashing unwearied warning for leagues across the German sea. That, however, is not the dissimilitude on which I wish to seize. Each of the towers, it has been mentioned, has an interior staircase. The lighthouse spiral is complete, and commands at the

summit a magnificent sea-view. That of the "Reform Folly"—such the nickname its defect has earned from those who had no goodwill to its being undertaken—is *all but* complete: only half a dozen steps or so are wanting at the top. But that want is decisive. You ascend by help of a glimmering light let in through chinks in the wall, increasing slightly from above as you near the summit; but the summit you never reach. You miss the view, that is all. The spectator from the other tower sees a dozen leagues off; so would you, by the aid of half-a-dozen steps: as it is, you see a couple of yards. So of that endowment gifted away with man's brain, from the under-brains of whatever grade withheld. The former means capacity, progress, light; the others, at the best, stagnation, darkness. In the works of God there is no failure, far less "folly;" but such is the barrier He has been pleased to raise. The brute has its own sagacity, but it is left a brute: the man has his own measure of capacity, be it more or less, but it is such as stamps him Man. The lowest human brain *has* all that manifestation of reason proper needs; the best-brained quadrumana *want* all. Even if the physical sign be adjudged slight,[87] the concomitant chasm is infinite. This so seeming-small a difference

links the highest brute in essential community with all lower life on the earth: it bespeaks the alliance of man with all higher life in the universe.[88]

47. That the inferior brains present a graduated approximation in physical characters to the human brain is certain. Associated with what we may call the *high-water mark* in this advance is a wondrous display of animal sagacity, as in the dog, the elephant, or the dolphin. The brute wave-brain is harbinger to the human, much in the same way as the highest of the sub-vertebrate types attain to close analogies with the vertebrate, or as the instinct of the bird is a finger-post to the mammal. But the stream is not bridged by the hoisting of signals on the opposite shore. Between mammal and sub-mammal an impassable gulf is fixed—the "kind, life-rend'ring pelican" the only form interposing. The same holds of vertebrates and articulates. Both exhibit a defined axis and a bilateral symmetry, which are either greatly less distinct or wholly wanting in the tribes below. In both there is an orderly *concatenation* of generally similar, and also similarly differentiated, parts. Head, thorax, abdomen—legs for walking, wings for flight—are as beautifully and incisively marked in insects as in the most highly or-

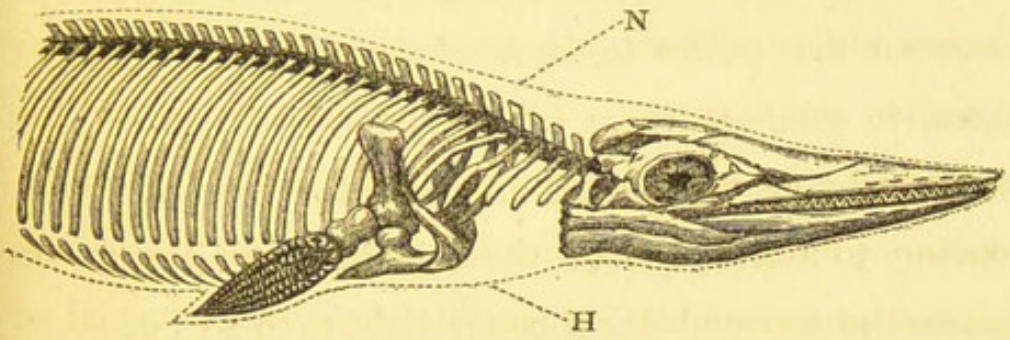
ganized vertebrates. As outwardly so inwardly. The complex mechanism ministerial to sensation, circulation, nutrition—nerve-system, blood-system, food-system—is distributed lengthwise in the line of the axis in both classes alike. These are neither dubious nor inconspicuous similarities. Yet the differences are of the most absolute kind. The articulate animal is outer-skeletoned and *tubular:* all the organs and tissues are packed promiscuously in a cylindrical shell, hæmal or blood-system uppermost, neural or nerve-system under.



Typical longitudinal section of an Articulate: showing the relative disposition of Blood, Alimentary, and Nerve Systems.

The vertebrate animal is inner-skeletoned and *columnar:* a central pillar, solid though in segments, forms the flexible floor of two opposing archways, strongly contrasted both in regularity and expansion, of which the upper is a scabbard for the nerve, and the lower a basket for the viscera. Thus the relative locations of the blood and nerve systems established in the articulate class are completely transposed. The precious nerve-

filament, in the vertebrate, is, like the electric wire, lifted out of harm's way; carefully extricated from the meaner tissues, and cloistered securely in its neural



Vertebrate Type; *Ichthyosaurus*: showing Neural and Hæmal Arches

arcade. The case then stands thus. Notwithstanding striking similarities in certain aspects of the general plan, there is no crossing the chasm between vertebrate and articulate. Despite most interesting adumbrations of maternal instinct in birds, there is no bridging the gap between mammal and sub-mammal. Finally, and in strict consonance with these fencing analogies, there is no physical community, as there is no spiritual communion, between the brains of brutes and the brain of man. The two differ as Organic Perfection must always differ from Organic Defect. Our greatest anatomist, combining in his survey the peculiarity of *parts* with the peculiarity of *proportions*, secludes, on strictly anatomical grounds, the human brain as alone 'archen-

cephalic.'* Evidence to the same effect, assuming the brain as the organ and index of intelligence, may be reached by another route. Pleno-cerebral and manco-cerebrals—"by their fruits ye shall know them." Between the power to form abstract ideas, to express them, to compare them, and the total *absence* of that power, who or what shall describe the interval? Recurring to our simile of the unfinished staircase, *b* is nearer the top and has a better light than *z*; but to be at *b*, as to be at *z*, is to be alike *deprived of the view.*

48. As therefore the first law of Divine election—type of skeleton—parts all possessors of the central column from the sub-vertebrate tribes; as the second law—that of mammalian motherhood — bars off the breastless vertebrates from the upper group of sucklers; even so this third law—the law of cerebration—erects the pleno-cerebral into the crowning division, of equivalent generality, and like inviolability, with those below. Man, in this view, is the only species of his genus, the only genus of his order, the only order of his class, the only class of his group.[89] He is, as it were, the third of the three steps by which God has stamped on living nature the harmonious image of His own boundless perfection—Power superinduced on mere life,

* Appendix G.

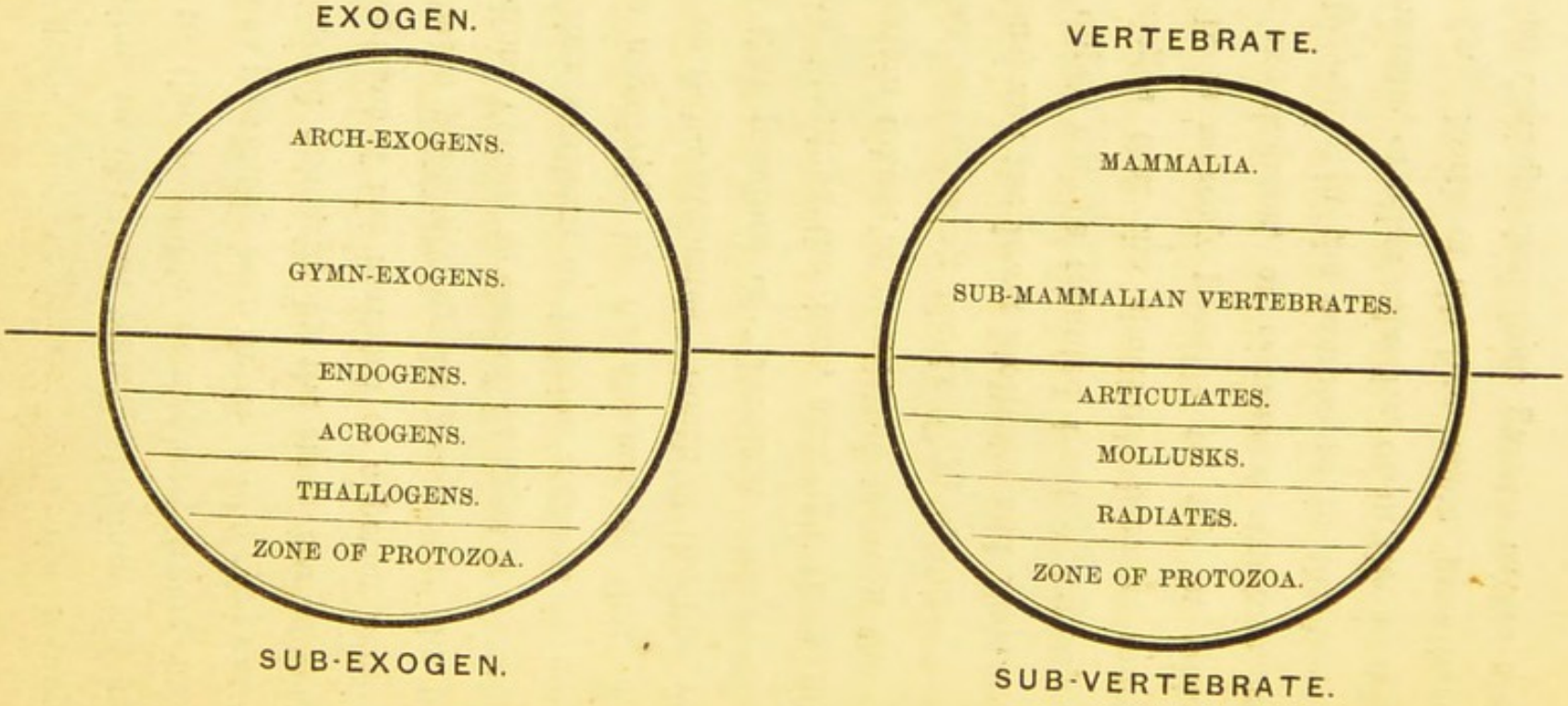
Love allying itself with Power, Wisdom at last blending with Power and Love, in the one being made in the image of his Maker. Till man appeared, the nature-revelation, to an intelligent mind set to study it, would have been, in various degrees, maimed and misleading. The cuirassed fish, or the fierce saurian, was a sign of power in the Creator, but of power alone. When the elephant first made his home in the forest, and the whale took possession of the deep, it would, however, have become safe to infer that love dwelt with power in the Divine author of motherhood. But only in presence of the capacities of human thought, and the achievements of human genius, and the attributes of human conscience, would it have been plain that Love and Power were not *all* the Infinite, but emanations of a Wisdom wonderful, unfathomable, and of purer eyes than to behold iniquity.

49. Viewed in this light, the typical ascensions of nature are transfigured into a progressive revelation of God. The grosser superstitions of history stand out, moreover, in their true colours as an ignorantly partial reading of that revelation, akin to a reading *ignorantly premature.* A survey of the saurian monsters, for ever hunting down their prey, might suggest a Deity delight-

ing in blood, till the *self*-sacrifice of mammalian mothers, and the inner voice that taught man "the quality of mercy" when he opened his ear to the lesson, uprose as witnesses to a benigner faith. The same principle supplies at once the origin and the correction of those worships which were the deifying of brute desire. Superstition, grasping part, creates a discord: religion, waiting for the whole, evolves a harmony.

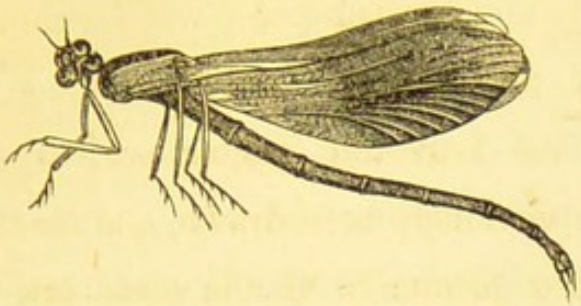
50. Our immediate concern, however, is less with the manifestation of the Divine essence and attributes in the series of created being, than with the testimony that series bears to Divine purpose and forethought. And this will become still more strikingly apparent if, appealing to criteria as yet untouched, we consider, ever so briefly, the weight that is due, first, to what may be called the Duplication of Ground-plan, and, secondly, to what may be called the Correlation of Superiorities.

51. It is not in the animal kingdom alone that Divine Method is traceable: there is a vegetable hierarchy as well. And if we figure these as twin hemispheres, embracing the whole world of organic nature, past as well as present, it is profoundly significant to find that the trenchant line of demarcation which cuts off the higher from the lower life is drawn on the same prin-


EXOGEN.
ARCH-EXOGENS.
GYMN-EXOGENS.
ENDOGENS.
ACROGENS.
THALLOGENS.
ZONE OF PROTOZOA.
SUB-EXOGEN.
VERTEBRATE.
MAMMALIA.
SUB-MAMMALIAN VERTEBRATES.
ARTICULATES.
MOLLUSKS.
RADIATES.
ZONE OF PROTOZOA.
SUB-VERTEBRATE.

H

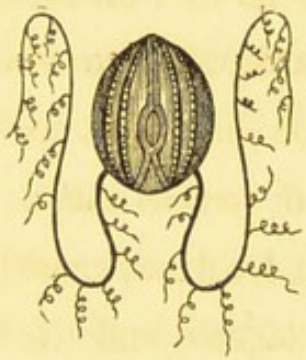
ciple in both, and expresses, with the appropriate modification, an identical plan.[90] Produce the animal equator to the vegetable hemisphere, where its own equator has previously been drawn, *and the two unite :* all life is bisected primarily by the same law of skeleton. Either segment of the northern or superior hemisphere is describable positively, by the presence of the first of the Cardinal Values, as that of Exogens or Vertebrates ; while either southern or inferior segment is only describable negatively by its absence, as that of Sub-exogens or Sub-vertebrates. South of the line, verging towards that province of " Protozoa " where the two kingdoms blend at the base, although there may be noted certain tokens of parallelism between the sexless or at least sex-masking plants (Cryptogams=Acrogens, Thallogens) and the lower Mollusks and Radiates, it is in the upper regions tenanted by the Articulate and the Endogen that the similitude becomes unmistakeable. It is scarcely possible to say in which the jointed exo-skeleton, or *circumsect* structure, is more typically seen ; in the bamboo or in the bee, in the common cane, or other calamite, or in the scorpion and dragon-fly. North of the line, again, growth *round* a centre, as distinguished from growth *within* a circum-



Articulate or Circumsect type: *Agrion Virgo:* akin to Dragon-fly.

Endogenous Type: Vegetable Kingdom: Ancient Calamite.

Molluscan or Convolute Type.



Radiate or Globulate Type:
Reiteration of parts around a centre:
Cydippe.

ference, appears as the common prerogative of the vertebrate animal and the exogenous plant; the condition in both, as regards the individual, of the higher vital architecture, and in both the basis of protracted longevity. And, passing from the sustaining framework, or *prop* of the organism—in plants the stem, in

animals the skeleton proper—which yields the first principle of natural classification, on to that second principle afforded by the greater or less elaborateness of provision for offspring—at which, since there may be no vegetable analogue to the law of cerebration, comparison may stop short—there emerges, as between the seed-exposing and the seed-sheltering groups of exogens (Gymn-exogens, Arch-exogens), a line of division strictly equivalent to that which parts, in the corresponding region, the mammalian and sub-mammalian zones. The bare double or multiple lobe (Di-poly-cotyledon) is a higher provision than even the sheathed and sheltered single lobe (Monocotyledon). But the vegetable envelope *accumulated* on the dicotyledon, as the earth waxed old, expresses, in its dumb way, the same maximum of solicitude for offspring, and the same care at once to foster and to shield it, as the manifold assiduities of the mammal. How fathomless the credulity which can persuade itself that the complicated parallelism in sexual adjustments, appearing thus far on in the two great kingdoms, is solved by idle jargon about "self-evolving powers!" Galileo's dungeon-straw and Newton's apple are stock legends of science. The straw, rightly surveyed, *is* the cure for atheism which the

Italian sage is said to have said it was. Yet Newton's apple—cut up—would have been a more potent antidote. Marvellous, indeed, is the whole sweep of the analogy. But who, perusing it with fresh eye, can possibly confound correspondence of design with identity of descent? The two series plainly have a common Architect. As plainly they have in nowise a common ancestry.

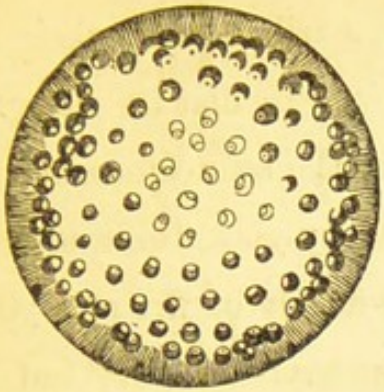
52. If this conviction needed rivetting and reinforcement, instead of being, as it is, abundantly secure by its own proper strength, we should only have to connect with Duplication of Outline, in the organic kingdoms, the simultaneous presence, throughout both, of Correlation of Superiorities. Not merely of co-adaptive and co-operating *structures*, set as yoke-fellows each to each, and each, in a sense, inter-necessitating the others. This indeed is a study second in significance to none of its class. The teeth, claws, and stomach of a lion or a cat are all correlated parts of a carnivorous whole; and so, on the herbivorous model, are the teeth, hoof, and stomach of an ox or a sheep. The furniture of each fabric is made to pattern. The organs so combined cannot change owners and cannot part company: they can neither be detached nor transposed: given one, you

have the key to the rest: no feline shall be found with ox-like teeth, no ruminant with cat-like claws. It was through his grasp on these truths that Cuvier became the founder of palæontology.[91] The principle on which he relied was that of the *congress* and conspiracy of means to ends. Where there are sails there will be masts. Where there are guns there will be powder. The blacksmith's bellows will not be found in the carpenter's shed, nor the carpenter's axe and plane beside the blacksmith's bellows. Cuvier's method rests on the conviction, inductively generated and inductively verified, that consistent adaptation, such as is seen in man's works, pervades the living workmanship of God. From the impressive tribute to Divine purpose which this method yields, or rather constitutes, the abusive construction of the phrase "conditions of existence" cannot detract. "Without uniting such conditions the creature could not have existed." It may be so; *but there was no necessity that the creature should exist.* We do not account for the mechanism of the loom by calling it a "condition of the existence" of cloth! Is it a whit more rational to apply this pretentious verbiage, for example, to the covering of animals? Between the cold-blooded reptile, which needs no clothing, and Man

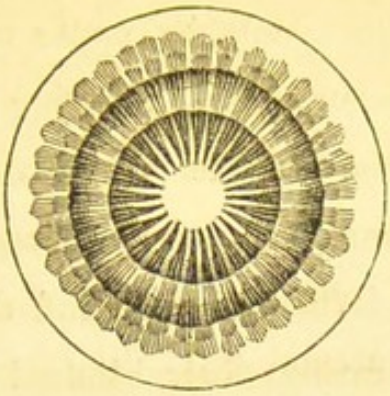
who can clothe himself, lies the vast and varied series of warm-blooded creatures which can "neither work nor want"—neither provide raiment nor dispense with it. All are clad, but how differently! The whale is wrapped in fat, the bear in fur, the bird in feathers; these last beautifully correlated, not only to warmth but to flight. Does the circumstance that all these provisions are each exquisitely suited to its own sphere, and all totally unlike save in utility to the animal, strip them of their providential character? Most truly they are "conditions of existence;" but who or what brought them together? We do not assign a reason when we record a fact. Flimsy, however, as this subterfuge is, in view of structures and organs more or less manifestly *mated* to one another, it has, if possible, still less plausibility as regards the subject immediately in hand—the Correlation, that is, of General Superiorities. For a certain *exuberance* of endowment, however significant and beneficial, is not a *sine quâ non* to life and well-being, and therefore does not touch the "conditions of existence." It is by no casual synchronism then, and assuredly by no necessity in the nature of things, that we find this conflux of opulence as we ascend the scale in both the organic kingdoms. Thus it is that the dicotyle-

donous embryo is attached to the exogenous stem, so that the vegetable equator defines itself almost as sharply by the build of the cradle as by the architecture of the house. The foliage, moreover, acquires a fresh beauty and elaboration; so that every tongue by which the plant can speak,—the stem, the embryo, the very leaf,—have all the same tale to tell. An objection to this manifestation of Divine order, which may occur to some minds, will not only vanish, but be transformed into a proof of what is doubted, by a closer attention to the exact state of the case. The Acrogen, like the still humbler Thallogen, has no cotyledon: the fungus, in this regard, is on a level with the fern. The Endogen has its single cotyledon; and also the seed-vessel, or *curtain* for the cotyledon, which is the less important organ in the economy of reproduction. The Gymnexogen has the complete cotyledon, which is, of course, in this view, the more important organ; but no distinct seed-vessel. The Arch-exogen has both. Now there is no real retrogression in this scale; the pine, in vegetable anatomy, takes precedence of the palm: but what might seem a defect in the endowment of the Gymnogen will be reduced to its true value when we reflect that the earth's vegetation has *effloresced at twice;* and that, at

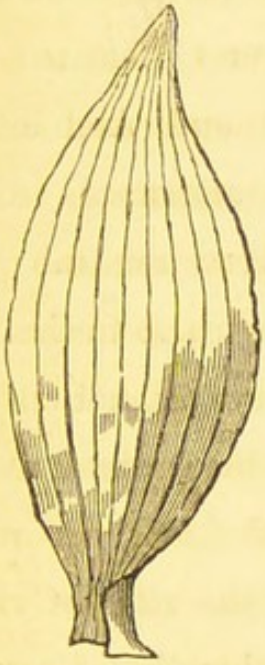
ENDOGEN AND EXOGEN: TYPICAL STEMS, LEAVES AND SEED-LOBES.



Palm Stem.



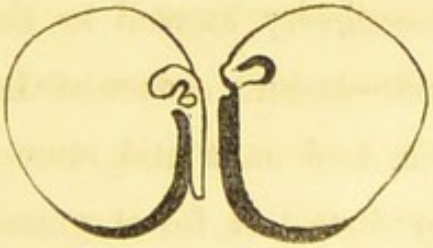
Oak Stem.



Tulip Leaf: Parallel-veined.

Cherry Leaf: Reticulated or Net-veined.

Monocotyledon:
Grain of Oats, vertical section.



Dicotyledon:
Common Pea.

each epoch, its upper and lower tribes made their appearance predominatingly *in pairs*. In that far antiquity when our fuel was alive, and in the ages following, the dwarf club-moss was represented by giants of the type; and the dwindled and decayed family of firs and yews, counting their kindred not as now by tens but by hundreds, made room for themselves far and wide, and filled the land. Acrogen and lower Gymnogen were then to each other what Endogen and Arch-exogen, with the higher Gymnogen, were afterwards in the nobler flora of the Tertiary times. If we remember that the Endogen, dating in its earliest garb from the coal-measures, has brought into these later ages, not only the palm, the lily, and the Iris, but also those grasses which feed our cattle, and, in their cereal forms, as wheat, rice, &c. yield, all the earth over, the staff of life to ourselves; and if we remember further that *Exogen* in its Tertiary climax means all manner of fruit as well as all shapes of beauty—means the fig, the grape, the peach, the cherry, as well as the myrtle, the geranium, or the rose—means cedars of Lebanon, and cypresses of America, and oaks and elms of Europe—means all orchard produce, all forest grandeur, all garden glory;—then perchance we may see something higher than "self-

evolving powers" in the arrangement but for which ferns would have been in lieu of corn-fields, and our choicest fruit fir-cones!—In the animal kingdom, as might be expected, the correlation of superiorities is equally or even more distinct. The vertebrate hemisphere is that of red blood; its avian and mammalian segments mark the limit of warm. It is also the region of the typical four limbs. Consistent with which is the occasional suppression, or, otherwise, the anticipating dawn of a characteristic endowment. Thus the serpent-tribe, latest born of reptiles, are shorn of limbs; the earth-worm is exceptionally red-blooded; *Amphioxus*, alone of vertebrates, is not. Yet there are no reversals of fundamental order; no platform for the creations of poetic fancy, far less for the revolting burlesque of Swift; no vertebrate centipede, no suck-giving reptile; no griffins, or mermaids, or satyrs, or centaurs. There emerges therefore throughout organic nature, consistently with entire freedom from pedantic stiffness and rigidity, an all-pervading harmony of ascensive endowments. Although in nowise chained together as cause and effect, one mark of superiority *tallies* with the others. How is all this to be explained on Darwinian principles? Why has natural selection been so cramped

or so capricious that it has never produced, all those infinite ages, a mammalian cuttle-fish, or a canine pleno-cerebral? If all life is a medley of hap-hazard melting upwards,—a pilotless drifting of type into type—whence this marvellous simulation of symmetry and system; of consistent subordination and of co-ordinated superiorities? Without the clue of Final Cause, indeed, the aggregate of living forms, though it opens a vast field for entertaining observation, ceases in strictness to yield materials for science. "Not only do all laws for the study of nature vanish when the great principle of order pervading and regulating all her processes is given up, but all that imparts the deepest interest in the investigation of her wonders will have departed too."[92] For here as everywhere, science is nothing but the deciphering of system; and if there is no system to peruse there is no science to construct. The difference between the 'artificial' botanic system of Linnæus and the 'natural' system of Lindley just amounts to this—that the one classification does not correspond (as it was not meant to correspond) to the *thought put into* vegetable forms, while the other approximately does. So precisely in the twin kingdom of organic life. System and symmetry are everywhere the signals of Prescient and Presiding

Mind. The earth "is telling" as well as the heavens; and it tells not of Development groping in the dark, but of God working in the light.

53. Step by step, indeed, is the great plan matured.[93] Were we speaking of a finite worker and a lower workmanship—comparing the Intuition which sees the end from the beginning with the process by which *we* feel our way painfully to improvement—we might, as has been already signified, conceive the first creative period as occupied in a series of experiments, resulting in the rejection of inferior life-fabrics, and in the fixing for plant and animal of the perfect Skeleton. Skeleton passed, Divine skill might be regarded as expatiating on the Reproductive System, sympathetically related in animals to the temperature and aeration of the blood. Mammalian structure reached, and its vegetable counterpart perfected, it might seem as if the assiduities of the great Architect were finally transferred to the Brain. In accordance with this view, though the language does not need to be similarly guarded and qualified, since it only expresses order, and not progressive insight or facility, the sub-vertebrate types may be contemplated as pioneers of the Backbone, the sub-mammalian vertebrates as heralds of the Breast, and

the under-brained mammalia, in their allotted grades, as harbingers of Pleno-cerebral Man.

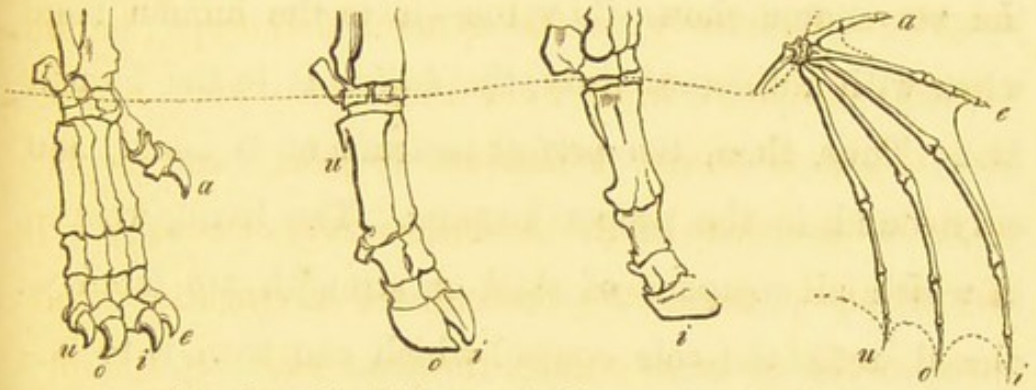
54. "To him that hath shall be given." . . . "What a piece of work is a man! How noble in reason! how infinite in faculty! in form and moving how express and admirable! in action how like an angel! in apprehension how like a god! the beauty of the world! the paragon of animals!"[94] . . . These are not the common-places of an inflated rhetoric, but the revelation of highest truth to highest genius. On one favoured head have indeed been lavished the choicest benefactions of unstinting Heaven. The prerogative gift is engirt with befitting satellites. There is a strictly human as there is a simply animal correlation of superiorities. The master-brain brings its ministers and credentials in the erect posture and the boundlessly endowed hand; in the patience of maternal nurture, and the life-long character of the love it typifies; finally, in the faculty of rational language—the 'articulate-speaking' tongue.

55. The first group of auxiliary endowments belongs to the correlation of the backbone. In man alone is the skull so poised on the vertebral column as in no degree to topple forwards. The column itself, subsiding ver-

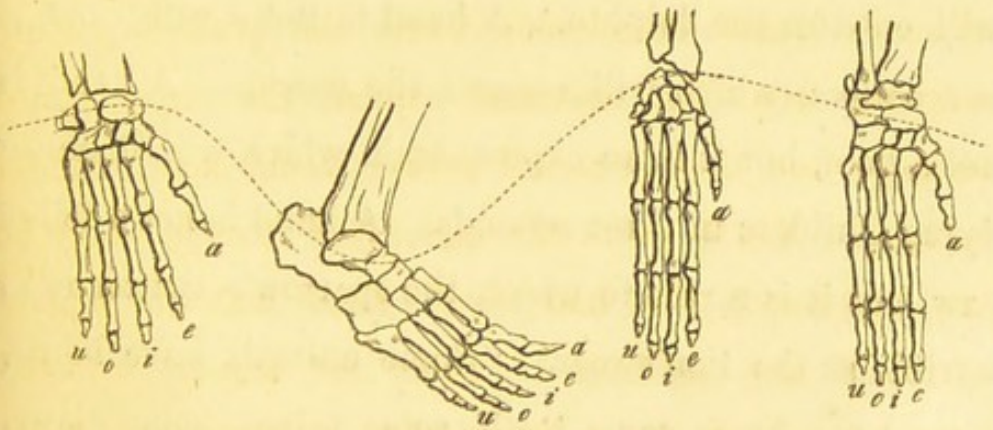
tically into its horizontal pelvic basin, is thence protracted perpendicularly into those diverging appendages which constitute the hind-limbs; and which are, in turn, articulated at right angles to feet so shaped and strengthened from heel to toe as to be a firm and sufficient prop for the upright fabric they have to sustain and propel. The collective result of these provisions differentiates the ape-posture from the human posture as the falling tower of Pisa is distinguished from the spire of Strasburg or of Salisbury. "In the pelvic as in the scapular extremity, the same digit which is the first to be rejected in the mammalian series, becomes, as it were, 'the chief stone of the corner,' and is termed 'par excellence' the 'great toe:' and this is more particularly characteristic of the genus *homo* than even its homotype the thumb; for the monkey has a kind of *pollex* on the hand, but no mammal presents that development of the *hallux*, on which the erect posture and gait of man mainly depend."[96] What with projecting heel, and what with consolidated toe, man is thus provided at once with a unique facility for rest and a unique fulcrum for motion. He stands freely when an ape stoops; he walks when an ape shuffles or totters. In case of need he can stand on one foot: no other mammal can

support itself on fewer limbs than two. If quadrumana, of whatever grade, were in full flight before a prairie-fire, they would retreat on all fours as certainly as buffaloes. Hence, among the many thousands of vertebrate species, man alone has his fore-limbs *to spare.* His feet suffice for motion: the anterior extremities are free. Free for what? There is no necessity in the nature of things that they should terminate in *hands.* They might, with fidelity to the general archetype, be immensely different from what they are. For example, they might be wings, or paddles, or paws; and in place of five digits there might be one, or two, or twenty. In any of these cases, the preliminary prerogative structures would be, in a manner, thrown away. If the digitation of the fore-limbs had been imperfect in any one of many quite conceivable ways, the perfect posture accruing from the balanced capital, the strengthened pedestal, and the horizontal pelvis, would have gone for nothing. Not to speak of wings, what if man, where he has now hands, had had *feet?* There was the general model of the quadruped. From the one-finger-footed horse—in which the suppression or coalescence of digits reaches its maximum, and the hoof of which is the exaggerated counterpart of the nail on the human mid-

finger, — through the two-finger-footed (cloven-hoofed) cow, up to the five-finger-footed cat, lies a series of structures suited for motion or for attack, but for nothing else. What could man have done or been with a horse-hoof hand, or with feline claws? Again, there was the general model of the quadrumana. But what if man, where he has now feet, had had *hands?* As it is, the types combine to yield each their best. Among



Homology of the third segment of the vertebrate fore-limb:
Lion's 'paw,' Ox and Horse 'hoof,' Bat's 'wing.'



Homotypes: third segment of fore and hind limbs
in Man and the higher Quadrumana.

creatures wholly quadrupedal or wholly quadruman,

man is the only creature who is both biped and bimanous. This, however, is not all. The hand-like extremity of the highest ape is rather a *hook* than a hand. Suppose the human hand with the outer joint, or distal phalanx, of the thumb lopped off, and you have something like the hand of the ape. But it is on the length and strength of this that all depends: the thumb is the making of the hand.[97] The *pollex*—or power-digit, for the very name shows its value—is to the human hand what, with a different duty, the *hallux* is to the human foot. Thus, then, the perfect instrument is found, and only found, in the proper keeping. The living weapon in which all weapons of skill or strength are latent is placed under the sole control which can turn it to account. A hand is not a paddle, but it is a ship which will out-tire the dolphin. A hand is not a wing, but it is a balloon which will outsoar the condor. A hand is not a hoof, but it is an express-train which will distance flying Childers in three seconds. A hand is not a feline paw, but it is a rifle to which the sparrow's twitter is as terrible as the lion's roar. "Some animals have horns, some have hoofs, some teeth, some talons, some claws, some spurs and beaks; man is weak and feeble, and sent unarmed into the world—Why a Hand, with reason to

use it, supplies the use of all these." [98] Thus to the Dædalus who can wield it, is the all-versatile instrument, the hand of the artist and the artisan, Dædalean in its finish and its powers, alone entrusted. With it he kindles his fire; for no brute is a fire-kindler; [99] and till man is, or where man is not, the fire belched forth by the volcano is the only terrestrial fire. With the hand he fuses his metals; with the hand he works his miracles. Nay, the hand, in his handling, becomes a voice and an orator. "Other organs help the speaker, but the hands themselves speak. By these we ask, we promise; we say, Come or Go; we threaten, we hate, we fear: joy, sorrow, doubt, confession, penitence; stint, generosity, number, time; what is not expressible by the Hand!" [100] So significantly *human* is this correlation. The value of the 'index digit' is well known to the painter. The 'shake of the hand' is appreciable by us all.

56. "The human being, lord of this lower world, is conducted to supremacy through the most protracted of ascents: none of the creatures that he rules have an infancy so helpless or so lasting: none furnish themselves so slowly with the knowledge needful for self-subsistence:—as if to him time were no object, and no

elaboration of growth were too great for his futurity." [101] This is the correlation of the breast: prolonged helplessness lays the foundation of life-long never-loosening love. The lower mammalia nurse their young and have done with them, as soon as they can shift for themselves. It is not their own kind, but Man, that seems, among those animals whose instincts are the finest and keenest, to have the power of rivetting an affection which shall last for life.* The dog that watched three months beside his master's corpse in the wilds of Helvellyn, and even the aged parrot that died of emotion too strong for its feeble spark of vitality, on hearing, after years of exile, a remembered tongue,[102] were worthy modern companions of the dog Argus, dying at Ulysses' feet; and another such has been added to the fraternity by the author of that masterpiece of manly pathos, "Rab and his friends." So true is it that man is, in a sense, "the god of the dog." The lower creatures, nevertheless, thus devoted to their master, only care for their own young while these require their care. But the devotion of the human mother, and the ties of which it is the representative, are lifelong. "Can a woman forget her sucking child, that she should not have compassion on the son of her womb?" expresses love unquenchable by the lapse of years.

* Appendix H.

Time but the impression deeper makes,
As streams their channel deeper wear.

Rachel weeps for her children, and refuses to be comforted. Rizpah, too, watches her slain sons "from the beginning of harvest till water dropped upon them out of heaven; and suffered neither the birds of the air to rest on them by day, nor the beasts of the field by night." The poor child-reft mother, hugging in her fevered imagination the infant dead forty years before, belongs, by right of retentive sorrow, to the same sacred group.[103] As if to show the mysterious compass of human nature—its contrast to that condition which renders the lower animals, in their several grades, mere duplicates of one another—its power of sinking to the devilish as well as soaring to the Divine—we have, as a foil to this, the most revolting form of murder; that of smearing poison on the breast.[104] "The corruption of the best is the worst." How beautiful is the true type-feeling in its tenacious devotion! how beautiful in the enkindled response and the exhaustless reciprocity! Take the pictured reunion—

The Maid that lovely form surveyed;
Wistful she gazed, and knew her not;
But Nature to her heart conveyed
A sudden thrill, a startling thought—

A feeling many a year forgot,
Now like a dream anew recurring ;
As if again in every vein
Her mother's milk were stirring.[105]

Or that legend of the Roman daughter which drew forth the tribute—

The starry fable of the Milky Way
Hath not thy story's purity ![106]

Or a dead mother's lineaments—

O that those lips had language ![107]

Or her spiritual revisitings—

Uttered not, yet comprehended,
Was the spirit's voiceless prayer ;
Soft rebukes, with blessings blended,
Breathing from her lips of air.[108]

All bespeaks the *indelible* character of human affection, sympathetically ramified through the correlation of maternity. It is this that makes history historical ; that throws on the page of the past its dominant lights and shadows. The masters of pathos and tragic terror have come hither in all times for their inspiration. Witness Hamlet and Lear. Witness, in shapes how different, Andromache and Clytemnæstra — the breast opened "tearful-smilingly" to receive Astyanax, the breast bared beseechingly to stay Orestes.[109]

57. Art and profound Feeling have each their correlation, through the meanings of the Breast and the ministries of the Hand: even so has Thought, and its organ the Brain, through the endowed human Tongue. The use of language, like the use of fire, meets us in the dawn of Hellenic literature, as the distinctive and demarcating note of man. Men have *words*, which are projected ideas; brutes have only *sounds*, which are projected sensations. Brutes vociferate: men speak. The physical organization is wedded to the mental capacity—a mouth, and wisdom. Neither, apart, would effloresce into Language: both must conspire and combine. So the one mind which has thoughts to be interpreted is furnished in the human tongue with an all-accomplished interpreter. Compared with the concealed nerve-filaments concerned in this office, "the meshes of the spider's web, or the cordage of a man-of-war, are few and simple. . . . The ape," on the contrary, "does not articulate, first, because the organs are not perfect to this end; secondly, because the nerves do not associate these organs in that variety of action which is necessary to speech; and lastly, were all the exterior apparatus perfect, there is no impulse to that act of speaking."[110] . . . The mere animal, with no

ideas to express or record, has no means, then, of expressing or recording them. In the case of man, with a tongue to utter speech, *and a hand to fix it*, one triumph of intellect accumulates on another, and achievement is piled on achievement as the centuries flit past: to him, "Time, growing old, teacheth all things." The world of brutes is bookless. A book is the product of a Mind, a Tongue, a Hand; a mind thinking, a tongue speaking, a hand writing: not any one, but all three. Articulate speech and its progeny —the alphabet, numerals, writing, printing, the electric telegraph—consider what man is with these, and what he would have been without them, and you have the means of gauging the significance of the correlation of the brain.

58. Even then if we restrict ourselves to indications that are of a mixed nature, and largely corporeal, taking no account of man's religious faculty—his sense of responsibility, his impulse of prayer, his forecastings of hereafter, his vision of the invisible; all the world of thought and feeling betokened by the bended knee, the clasped hand, and the uplifted eye—there still arise differentiating prerogatives which no residuary similitudes can mask or stifle, and which part him

peremptorily from the brutes. Nor are these supreme superiorities self-elaborated: "it is HE that hath made us, and not we ourselves." There is indeed a species of self-jugglery by long and patient persistence in which this truth may cease to be seen. "The theory of transmutation of species has met with some degree of favour from many naturalists, *from their desire to dispense, as far as possible,* with the repeated intervention of a First Cause. . . . Doubts are engendered in the student's mind as to whether species may not be equally unreal [with genera]. He is probably first struck with the phenomenon that some individuals are made to deviate widely from the ordinary type by the force of peculiar circumstances. . . . How far, he asks, may such variations extend in the course of indefinite periods of time? . . . His first opinions are now fairly unsettled, . . he is in danger of falling into any new and visionary doctrine which may be presented to him; for he now regards every part of the animate creation as void of stability, and in a state of continual flux. . . . Henceforth his speculations know no definite bounds; he gives the rein to conjecture, and fancies that the outward form, internal structure, instinctive faculties, nay, that reason itself, may have been gra-

dually developed from some of the simplest states of existence—that all animals, *that man himself*, and the irrational beings may have had one common origin; that all may be parts of one continuous and progressive scheme of development; in fine, he renounces his belief in the high genealogy of his species, and looks forward, as if in compensation, to the future perfectibility of man, in his physical, intellectual, and moral attributes."* Is this sketch of the pantheist's progress a portrait or a prophecy? Certain it is that Mr. Darwin makes boast that he met a Mentor, and has led captive a disciple.

59. Till this eminent authority shall himself recall and cancel expressions of opinion than which none sounder or more sensible are associated with his name, we may pardonably, notwithstanding, ascribe Mr. Darwin's vaunt to the self-deceptive eagerness of precarious speculation to impress into its service influential support. But the "Origin of Species," beyond all doubt,

* Lyell's *Principles of Geology*, B. III. Ch. ii. Compare—"Judging from the past we may safely infer that not one living species will transmit its unaltered likeness to a distant futurity. . . Hence we may look with some confidence to a secure future of equally inappreciable length. And as Natural Selection works solely by and for the good of each being, all corporeal and mental endowments will tend to progress towards perfection."—Darwin, p. 489. "I have reason to believe that one great authority, Sir C. Lyell, from further reflection entertains grave doubts," &c. p. 311.

has made proselytes of note elsewhere: nay, it has been hailed with plaudits, and paraded with rapture, befitting the most blessed of revelations. "A work has now appeared by a naturalist, of the most acknowledged authority, Mr. Darwin's masterly volume, . . which now substantiates, on undeniable grounds, the very principle so long denounced by the first naturalists,—*the origination of new species by natural causes*: a work which must soon bring about an entire revolution of opinion in favour of the self-evolving powers of nature."[111]* Suppose, by way of antidote to "celebrated divines," we imbibe a small dose of the Positive Philosophy. "All organisms may be regarded as having been produced by each other, if we only dispose the environment with that freedom and prodigality *so easy to the artless imagination of Lamarck.* The falsehood of this hypothesis is now so fully admitted by naturalists that I need only briefly indicate where its vice resides. . . . Though the solicitation of external circumstances certainly does change the primitive or-

* Even Professor Jowett, who can write in such a different tone at other times, expresses himself thus: "It is possible, and may one day be known . . as others say, that the supply of links which are at present wanting in the chain of animal life may lead to new conclusions respecting the origin of man."—*Essays and Reviews*, p. 349.

ganization by developing it in some particular direction, *the limits of the alteration are very narrow.* . . To regard the introductory animal as containing, not only all the tissues, but all the organs and systems of organs, is incompatible with anatomical comparison. . . Human intervention, affording, as it does, the most favourable case for alteration of the organism, has done nothing more than alter some of the qualities, without touching any of the essential characters of any species ; *no one of which has ever been transformed into any other.* No modification of race, nor any influences of the social state, have ever varied the fundamental and strongly marked nature of the human species. Thus, without straying into any useless speculations about the origin of the different organisms, we rest upon the great natural law that living species tend to perpetuate themselves indefinitely, with the same chief characteristics, through any exterior changes compatible with their existence. . . We may now proceed on the conception that the great biological series is necessarily discontinuous. The transitions may ultimately become more gradual, in process of discovery, but the stability of species makes it certain that the series will always be composed of clearly dis-

tinct terms *separated by impracticable intervals.*"[112] It is thus that the arch-atheist of our century uplifts his chastising voice to apprise defenders of the faith, in their alacrity of surrender, that they are parting with the keys of an unimperilled citadel!

60. It is not the office of Palæontology to minister answers to the deepest and most anxious questionings of the human spirit. And yet it will render no slight or superfluous service if it supply, in an age like this, a pedestal and a socket for truth still more majestic and more concerning than its own. We may concede to Mr. Jowett that religion has as little to hope as to fear from antiquarian explorings on the Tigris or the Nile.[113] But it may be that monuments not made with hands have a more sure word of prophecy committed to their inviolate keeping, and sculptured on their imperishable walls. If there be a religion which plants on the lips of its disciples an acknowledgment of the Divine Name—All-wise, All-merciful, All-quickening—"Wisdom, Love, Might"—such in indivisible attribute, such also in distinctive manifestation, there are foreshadowings of that same faith, neither faint nor fancy-born, in the changeless creed of nature. If the religion ascribe to the Creator of the world a capacity of living interest in his intel-

lectual offspring, there is evidence of a like capacity, enough and to spare, at more ancient epochs and on a lowlier field. If History, co-witness to a Sacred Literature—the 'gulf-stream' that warms the waters of the human Atlantic—postulates a method of Divine Election; nations chosen for leading tasks in the development of humanity; one chosen in special as the ark of its prophets, and the cradle of its Divine Master and Head;—this also is strictly congruous to that working of Creative Will which placed an elect nature on the earth, and seems its fitting consummation and copestone. If Christian religion demands the concession of power strictly miraculous within the human period, an earlier record that compels assent to its demonstrations refuses to part with the proclamation of it. If type, which is unspoken prophecy, be thought an unworthy vehicle of Creative purpose, it is at least anticipated in that system whose converging symmetries led up to man. Such and such-like is the writing "graven in the rock for ever." The stony records, it is true, offer no entrenchments to undiscriminating prejudice, and no consecration to reverenced illusions: on the contrary, they uplift warning, legible and audible, where there is wisdom to look and patience to listen, against the danger that accrues to

faith from exaggerated dogmatism, or from rash implication of Divine authority with the inexperienced interpretations of the human understanding.[114] But all the more impressive is their serene and silent protest against undisciplined and reactionary impatience of the supernatural, involving the substitution of an omnivorous credulity for the reverent and rational recognition of the handiwork of God. Schemes conceived in this spirit will have their day, and will run their course; greeted as they appear with the halleluias of materialism and the jubilation of the sceptic. But they will pass away, and their place will nowhere be found. It will be seen that the grand transitions of animated being are due, not to the blindfold ebullience of nature, but to the ordered onstep of the Almighty. The unswerving fidelities of the realm of instinct will correct the aberrations of perverted reason: "the dumb ass, speaking with man's voice, will rebuke the madness of the prophet."

APPENDIX.

A.

ON THE VALIDITY OF THE ARGUMENT FROM DESIGN.

The Argument from Design has been challenged *metaphysically*. Is it easier, it has been urged, to conceive of a Designer without antecedent design than of seeming design without an antecedent Designer? If the Supreme Contriver may exist uncontrived, may not man, or anything? True, man is wonderful, and may seem to have been made; but is God less wonderful, and who made the Maker? If God caused all things, what caused God? Is the difficulty involved in the fact that the human being *is*, abated by the hypothesis that the Divine Being *was* before it?

Let us probe this sophistry; and vindicate the validity by making plain the limitations of the Argument from Design.

Experience is our sole instructor within what limits it is necessary or possible to predicate causation of things around us. That causation has limits, is demonstrable. To the postulate—"Everything which exists has had a cause"—it is obvious to reply that something must always have existed uncaused, else nothing could be in existence now. On the other hand, causation, within certain limits, is demonstrated. The formula—"Nothing is an effect"—is as palpably false as its opposite. The truth therefore must reside in a medium proposition—"Certain things existing *as they exist* have a cause for their so existing." Here we seem to trace that frontier-line within which there is light, and beyond which there is darkness; within which, consequently, inference is legitimate, beyond which, speculation is vain. For a thing's *being*, we can give no reason; for its being *as it is*, we very generally can. For experience acquaints us with two orders of forces—forces of matter and forces of intelligence—which are con-

stantly operating two sets of results, each bearing the impress of its origin. Thus it is *Wind* that fills the sails of a ship on the ocean, and *Mind* that steers the helm. The forces thus broadly distinguishable supply our only notion of cause, and their respective results exhaust our knowledge of effect. It is certain that matter is susceptible of being modified by powers *devoid of intelligence* in themselves considered, as heat, gravity, electricity. It is also certain that matter is susceptible of being modified by *intelligence itself*, as when stone becomes a wall, or iron a knife, beneath the shaping skill of man. On these twin certainties then, on the reality of the distinction alleged between them, and on our ability to apply and reason from such distinction, does the present argument turn. Our ignorance does not invalidate our knowledge. That there are ultimate facts of which causation is not predicable is no reason for declining to predicate causation of facts *distinctly extricated* from that category. What *order* of causation is required to account for any fact so extricated—whether *e.g.* the first human pair owed their origin to non-conscious Law or to Designing Mind—depends on the comparison of the fact so extricated with the observed capacities of given causes to produce given effects. With the mysteriousness of these causes we have no concern. *They exist, and the effects do not exist without them.* How things *are at all* we know not: how they are *as they are*, in certain cases, we, by adequate observation and just inference, know. Gravity may be due to nothing; but the shape of the earth, not the less surely, is due to gravity. Mind may be the work of nothing; but the structure of the Eye is, not the less surely, the work of Mind.

Be it noted precisely how the argument stands. Its chemical constitution out of view,* we do not believe in God because matter IS. We should not simplify the problem of a presumptively eternal matter by *under-propping* it, so to say, with a presumptively Eternal Spirit. To suppose matter the product of intelligence removes no difficulty. The fact is of parallel simplicity with the proffered explanation.

Nor again do we believe in God on account of the non-numerical

* Sir John Herschel, in addressing the Royal Society (1845), remarked: "These discoveries (definite chemical proportion) effectually destroy the idea of a self-existent matter, by giving to each of its atoms at once the essential characters of a *manufactured article* and a *subordinate agent*." Although therefore "neither astronomical nor geological science affects to state anything concerning the first origin of matter," (*Essays and Reviews*, p. 218), *chemical* science confirms the doctrine of the Mosaic "cosmogony."

PROPERTIES or laws of matter. Heat and gravitation are each as simple as the Divinity. The affections of body, with the exception indicated, may, for aught we know, or are entitled in the first stage of our induction to affirm, be alike necessary with its essence, and alike inexplicable. Interference *ab extra* has never been observed to produce analogous phenomena. It cannot therefore be required to account for these.

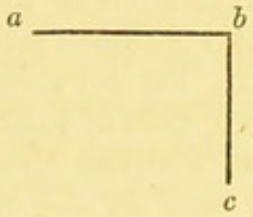
Nor yet do we infer the divine existence from the phenomena of pure CONSCIOUSNESS. Were we disembodied spirits, without knowledge or memory of any beginning, it would probably never occur to us to search after a cause for our own existence. The known existence of one spirit could not be simplified by the supposed existence of another. To say that intelligence is required to produce intelligence would be to say that intelligence is required to produce God. We should, therefore be impelled to class our purely spiritual existence with other ultimate facts, mysterious, doubtless, as *all* existence is mysterious, but not susceptible of being made less so by our multiplying assumptions of kindred and parallel mystery. *Once prove* the existence of a Divine Creator, and it will become necessary and rational to refer all else to Him—the affections of matter, the operations of mind. But *from* these things we cannot prove that existence. *

How, then, is that existence proved, or rather—for the argument is a strict induction—certainly inferred? Simply and solely from COLLOCATIONS, DISPOSITIONS, and ADAPTATIONS of matter which are perceived to be analogous, not to the known results or capacities of Law, but to the known energies and capacities of Intelligence. Were the city of London to be swallowed up by an earthquake and the island of Great Britain to be swept of human inhabitants, we do not

* "We study the nature and operations of the mind, and gather from them marks of design . . . Among the most remarkable of these is the power of reasoning," &c.—Brougham's Discourse on Natural Theology, Part I. Sect. iii. But is reason in the *Divine* Mind a "mark of design"? It is essential to discriminate between mind *as such*, and mind *as domiciled* in a physical frame into which it must have been *put* by the Author of that frame; or again mind *as instructed* and directed by other mind. Coleridge tells the story of an illiterate servant-girl who spoke Greek verses in a fever. It turned out that a former master had been in the habit of reciting these aloud within her hearing. The instinct which enables the unreasoning bee to avail itself of the utilities unfolded to man by the most refined investigation (*Appendix* D.) refers us, in manner analogous, to a *prompting Mind*. But mind *as such* cannot be considered as necessarily indicative of design.

believe that Law would ever repeople the waste any more than we believe it would rebuild the city. The English insect would never "develope" or "select" into the English dog, or the English dog into the English man, any more than the unquarried rock would "develope" into the towers of Westminster, or "select" into the dome of St. Paul's. What is thus prospectively so evident, when put as a hypothesis, is no less evident in retrospect, when surveyed as a reality. We are entitled to believe, and impelled to pronounce, that what Law *could not do* in the future it *has not done* in the past.

The principle of the argument rests on two axioms, each certain to a demonstration. Something *is* caused. Something is *not*. There is causation somewhere. Causation cannot be everywhere. We are shut up to affirm causation of some phenomena. We are equally shut up to deny it of all. Let a block of marble *a* be the effect of nothing :



the configuration of parts in the Apollo *c* is, we know, the result of skill and intelligence. Interposing between these the contested phenomenon Man, the question simply is, *to which is he similar?* On which line of analogy must he be laid ? Is he an ultimate fact, like the marble ; or, like the sculpture, a monument of design ? The inquiry is as legitimate as the reply is clear. Natural Theology places one finger on the superb statuary : she points with another to the far more superb and complex original : she claims for both the character of *effect*, effect of intelligent cause. The moulding intelligence may be mysterious, so also may be the material moulded ; but the former has stamped a signature upon the latter by which itself is known. There is no tendency in nature to produce men and women any more than their marble *simulacra*. The human frame is matter marshalled by Omnipotence not less surely than the mimetic statuary is matter marshalled by man.

The Argument from Design, then, is valid, and it is complete. Conviction that a given effect is strictly supernatural is the appropriate primary basis of belief in supernatural cause, that is, in God. No subtle "demonstrations" consisting of ingenious word-play will supply its place. An earnest faith cannot be built on metaphysic

quicksands: attention is only wasted in listening to oracles that either give us verbiage in lieu of reasons, or asseverate loudly that we must believe without reasons, that no reasons can be given, and that no reasons are required.

B.

ON THE NATURAL IMPRESSIVENESS OF THE ARGUMENT FROM DESIGN.

The following passages are assembled on the principle of showing the force with which this argument has struck thinkers of all schools, times, and countries; in some cases, as in that of Kant, despite themselves:—

1. *Socrates.*—"Having heard that Aristodemus ridiculed the worshippers of the gods—'Tell me,' said he, 'O Aristodemus, if there are any men you admire for their wisdom.' 'I do.' 'Their names?' 'Homer as an epic poet, . . . Polycletus as a statuary, Zeuxis as a painter.' 'And which think you are the more worthy of admiration—the framers of images, mindless and motionless, or the framers of creatures full of life and energy?' . . . 'Does not He then who made men in the beginning seem to you to have given them *for use* their several organs of perception—eyes to see sights, ears to hear sounds? . . . Seems it not to you the work of forethought to have fenced the delicate vision with eyelids, like doors, thrown open when it is necessary to see, but closed in sleep? . . . Or to have placed the cutting teeth in front, and the molars behind? . . . Is it doubtful whether all this be the work of chance or of premeditation?'

. . . . . .

'Be sure, O Socrates, if I were persuaded the gods had care for man, I would not neglect the gods.' 'Thinkest thou not they care for man? They who made man erect, and able to look upward; and giving lower creatures only feet to walk withal, have furnished man

with hands to work those things which pertain to his superiority? And though all brutes have tongues, they have made man's tongue only so adroit and nimble as to achieve articulate speech, and to give signal of all our thoughts in sounds. . . . Moreover, besides caring for man's body, they have implanted in him his most excellent part, the soul. What other creature can apprehend or worship the Deity? . . . Nay, are not men as gods, among the other creatures, excelling them, in virtue of their nature, both in body and soul? For the mind of man would be powerless to fulfil its purposes if lodged in the body of an ox; and hands without mind do not raise the ape above brutes. Yet you, Aristodemus, endowed with both, doubt the care of the gods. What would you have them do for you to show their care?' "—*Memorabilia*, Lib. I. c. iv.

2. *Cicero.*—"He who ascribes the constitution of the universe to chance, I understand not why he should not also suppose that a vast quantity of the one-and-twenty letters, made of gold or any other material, might, if thrown promiscuously on the ground, arrange themselves spontaneously into the Annals of Ennius. . . . Admirable is that of Aristotle: 'If there were a race of men who had always lived under ground in splendid mansions, furnished with pictures and statues, and all other luxuries of the rich; and if, never having visited the surface of the earth, and having only heard by vague rumour of a certain Divine Power, they were suddenly to be ushered, through a cleaving of the earth, to the upper region, so that the whole panorama of nature should at once burst upon their view: when they should take in at a glance earth, sea, and sky; when they should note the greatness of the clouds and the force of the winds; when they should survey the sun in his glory and power, diffusing light by day, and see the whole heaven bespangled with stars by night, and watch the variations of the waxing and waning moon, and the punctual courses of the stars;—assuredly they would conclude that there were gods, and that these were their godlike works.'*

. . . . . .

* The general impression was shared by Plato. Yet how crude and wild the most advanced conception of cosmical beginnings among the ancients was!—The Mosaic "Cosmogony" has recently been the subject of an elaborate impeachment. "Inspiration," as Michaelis long ago distinguished, "is not Omniscience:" the thing hypothetically required is not the miraculous anticipation of scientific truth of detail, or the revealing of such knowledge before its time, but such an Influence as should

"Need I speak of the bones and their joints so wonderfully adjusted both for stability, and motion, and action? Or of the nerves by which the body is pervaded? . . . To this providence of nature many things fall to be added from which may be gathered what excellent prerogatives the gods have bestowed on men; as in conferring the erect *posture*, that they alone of living creatures might look to heaven and reach the knowledge of the gods. The senses also, as interpreters and messengers, are located in the head as in a tower, wonderfully subserving their appointed uses. . . . He, moreover, who does not ascribe the mind and reason of man to the Divine care, seems to me to be himself destitute of mind and reason. . . . What a gift is *speech*, and what incredible skill has been shown in the machinery on which it depends? . . . To the

secure that, *when the knowledge came*, the general dignity, congruity, broad truthfulness, and religious impressiveness of the lesson, should suffer no harm from the advent of such knowledge. This harm has not happened from Modern Astronomy to the eighth or the nineteenth Psalm; nor yet will it happen from Geology to the first chapter of Genesis. Could as much be said for the highest flights of the unaided human reason of ancient time in the same region of speculation? The most profound modern thinker, of reverential mind, will feel himself in communion with a certain Divine Insight, as he listens to the reverend record from which his flippant inferiors so glibly derogate. But even the latter might own the difference between inspiration and the want of it, if the *Timæus* of Plato were read in churches instead of the "Cosmogony" of Moses.

Perhaps the class of difficulties now alluded to might be abated were it kept in mind that as in Scripture the recognition of the Divine does not imply the suppression or coercion of the Human, so the frankest recognition of the limitations of the Human does by no means negative the co-presence, in its own sphere, of the Divine. The reader will find some admirable remarks on this head in Dr. Hannah's volume on *The Fall and its Results*, pp. 28-32 (Rivingtons, 1857.)

I have spoken of the "broad truthfulness" of the Sacred Record. It is not at all necessary to the reality of the inspiration of Moses that he himself should have been aware of the *receptivity* of the mystic "days." And yet is there nothing striking in the coincidence that modern science should have chosen for the last great efflux of Creative Energy a name borrowed from the conception of darkness and the dawn? *(Eocene.)* Or, again, assuming the Fifth and Sixth "days," or Creative segments of duration, as *receptive* of the Mesozoic and Cænozoic Fauna, (culminating in Man—for whom *a priori*, although this would have been discrepant with geological fact, a distinct "day" might have been expected), is it not worth a thought that the naturally closer affinity of all the Cold-blooded Vertebrata *inter se* is reflected in the "great sea-monsters" and "winged fowl" of verse 22, while the "cattle" or milk-givers of verse 24 (with the Ophidians and Carnivora, "creeping thing and beast of the earth") is as exact an expression as language can afford for the Typical Mammalia of Tertiary times?—These correspondences are not *essential*, it may be, to that function of the record over which inspiration may be held to have kept guard. But are they simply casual? Does even Plato afford the like?

tongue, bounded by the teeth, and comparable to the *plectrum* of a musical instrument, do we owe articulate sounds *(sonos vocis distinctos et pressos)*. . . . How apt an instrument also, and ministerial to how many arts, has been given to man in the *hand!* . . . To our hands we owe our clothing, our habitations, our food. . . . These make fields, mountains, streams, crops, and trees our own. By these we fertilize the lands, and control at will the course of rivers. By these we strive to create in nature's self another nature. As for man's *reason*, has it not entered the very heavens?" —*De Natura Deorum*, II. xxxvii. lv-lxi.

[Cicero, III. xl. makes these arguments, which he puts into the mouth of Balbus, his own.]

3. *Galen.*—"Man is the wisest of animals, and his hands are organs suited to a wise animal. For man is not the wisest, as Anaxagoras said, because he possesses hands; but, as Aristotle rightly held, he has had hands given him because he was the wisest. For not even the hands taught the arts to man, but his reason. The hands are but the handmaids of these arts; as the harp is of the musician, and the tongs of the smith."

. . . . . .

"Try if you can imagine a shoe made with half the skill which appears in the skin of the foot. . . . [With reference to some one who thought the structure of the human body improvable:] Were I to spend more words on such, reasonable men might blame me for desecrating my work, which I regard as a religious hymn in honour of the Creator."—*Galen, quoted by Sir C. Bell and Dr. Whewell.*

With this may be contrasted the warning of Lucretius, IV. 823-857.—*Illud in his rebus*, &c.:—

"Be most wary, in these discussions, against the error of fancying that the eyes were created in order that we might see, or the legs that we might walk. . . . The tongue was before speech, and the ear before sound. . . . It is out of the question to suppose that they were made for use."

4.—"Kant treats with a little more indulgence the proof drawn from the order of the world. 'This argument,' says he, 'is deserving

of respect. It is the oldest, the clearest, and the best adapted to the common sense of mankind. It vivifies and strengthens the study of nature; it leads to the discovery of ends which observation alone would probably never have attained to, and at the same time extends our knowledge. . . . It would then not only be depriving us of a consolation, but attempting the impossible,—the attempt to lessen the authority of this proof. Reason, incessantly elevated by arguments so powerful, and which are perpetually increasing in strength, can never be so lowered by the uncertainties attaching to a subtile and abstract speculation as not to be drawn from every sophistical doubt, *as from a dream*, at the sight of the marvels of nature, and the majestic structure of the world, and so, from greatness to greatness, arrive at the Supreme Power."—Victor Cousin's *Lectures on the the Philosophy of Kant, Lect. VI.*

5.—"The argument from Fitness to Design may be ill-applied; but the question arises—Can it never be trusted?

"A lung bears a certain relation to the air, a gill to the water, the eye to light, the mind to truth, human hearts to one another; is it gratuitous and puerile to say that these relations imply design? There is no undue specification here, no antagonist argument, no intrusion of human artifice; we take the things fresh from nature. In saying that lungs *were intended* to breathe, and eyes to see, we imply an argument from Fitness to Design, which carries conviction to the overwhelming majority of cultivated as well as uncultivated minds. Yet, in calling it an argument, we may seem to appeal to the logical faculty; and this would be an error. No syllogism is pretended, that *proves* a lung to have been made to breathe; but *we see it* by what some call Common Sense and some Intuition. If such a fact stood alone in the universe, and no other existences spoke of Design, it would probably remain a mere enigma to us; but when the whole human world is pervaded by similar instances, not to see a Universal Mind in nature appears almost a brutal insensibility."—F. Newman, *The Soul*, p. 32.

6.—"See how the scheme [atheism] works on a great scale in the material world. The solar system has a sun and numerous planets; they are all distributed in a certain ratio of distance; they move round the sun with a certain velocity, always exactly proportionate to their distance from the sun. . . . .

"Now the atheist must declare that all this order of the solar system was brought about by the fortuitous concourse of matter, and indicates no mind, plan, or purpose in the universe. This is absurd. A man might as well deny the fact of the law of the solar system, or the existence of the sun, or of himself, as deny that these facts, thus co-ordinated, indicate a mind, denote a plan, and serve a purpose calculated beforehand.

"See the same thing on a smaller scale. The composition of the air is such that first it helps to light and warm the earth, is a swaddling-garment to keep in the specific heat of the earth, and to prevent it from radiating off into the cold void spaces of the universe. Next, it helps to cleanse and purify the earth, by its free circulation as wind. Then, it promotes vegetation, carries water from the Tropics to the Norwegian pine, furnishes much of the food of plants, their means of life. Next, it helps animal life, is the vehicle of respiration; all plants that grow, all things that breathe, continually suck the breasts of heaven. Again, it is a most important instrument for the service of man. Through this we communicate by artificial light and artificial sound. Without it, all were dumb and motionless: not a bird could sing or fly, not a cricket creak to his partner at night, not a man utter a word, and a voiceless ocean would ebb and flow upon a silent shore. . . . . .

"If I should say that this sermon came by the fortuitous concourse of matter, that last Monday I shut up pen, ink, and paper in a drawer, and to-day went and found there a sermon which had come by the fortuitous concourse of pen, ink, and paper,—every man would think I was very absurd. And yet I should not commit so great a quantity of absurdity as if I were to say 'the composition of air came by the fortuitous concourse of atoms;' for it takes a much greater mind to bring together and compose the air which fills a thimble than to produce all the sermons and literature of the world.

. . . . . .

"Every part of the universe is an argument against atheism as a theory thereof."—Theodore Parker, *Theism, Atheism, and the Popular Theology*, pp. 7—10.

7.—"But, the laws of nature! inflexible, insensible, but all-moving; do they not reduce the universe to a regular perpetually-going piece of clockwork, and exclude mind by filling all with lifeless iron mechanism. . . . Trace causes and effects then, O philoso-

pher! examine minutely each part of what you see, and say if the phantasm of a Causing Mind will not be gradually pushed out of the universe.

"Yes, by resting in a minute examination of parts only, and overlooking the result of each whole. Thus might mind be excluded from man and his works. What work of art is there, in which the aim and intent, *i. e.* the mind, of the artist may not be missed, if we confine our attention to groping amongst the details? The examination of these may let us into the secret of the *means* which he has employed to bring about his purpose; but to seize this purpose, and read his meaning, we must look at the whole working and effect. Is it a sufficient explanation of the steam-engine to give, in correct detail, the connexion and dependence of each of its parts; to show how the working of one part must necessarily follow the action of the preceding; to state that the water must be raised from the well, because the upward motion of the bucket is the necessary sequence of the motion of the wheel, as this is caused inevitably by the motion of the beam, which follows of necessity the stroke of the piston, which could not but result from the pressure of the steam, which must proceed from the action of heat upon the water in the boiler? And here might an indefinite further chain of mechanical causes be supposed; but this tracing of the chain of sequences leaves all the while unexplained the cause of the whole work. Each successive link suggests more forcibly the idea of something more, which arranged the train of material causes and effects, so as to end in an apparently contemplated result.

"This explanation of the sequence of action in the successive parts would seem an absurdity, if offered as the sufficient cause of any piece of human art. Why, then, should it satisfy us any more in the works of nature? The chains of cause and effect in these are longer, and reach back farther, than we can follow; in few of them, if any, can we arrive at the link where the Causing Mind itself operated upon matter. Nevertheless, here matter seems no more gifted with the power of arranging itself, than in brass wheels and iron bars; nor of contemplating, any more than they, the beautiful and useful result in which this long chain of adaptation ends. Do the sun, the rain, the soil, the roots, and the sap-vessels, take counsel together to form the flower? If they do not, something else must; or the flower appears before us as a fortunate accident. What a vast assemblage of fortunate accidents make up the universe! For

here, millions of chains of causes and effects end in results beneficial to sentient beings; and all these separate results harmonize together in a beautiful whole.

"The more science advances, the more does it appear that all parts of nature are connected. Not only is the air about us adapted to the organs of plants and animals; but the light from the farthest star finds itself at home on the retina of man. . . . . What is this Something, which has tied all nature together in a mysterious and beautiful connexion? What answer can satisfy us as to this deep-working and all-pervading somewhat?—Cause and effect?—an inherent property of Order in matter?—a Law of nature? None of these; but a Causing Mind."—Hennel's *Christian Theism*, pp. 30–32.

8.—"The present is not the place for even the briefest summary of the arguments which have been adduced by teleologists and anti-teleologists from Democritus and Plato down to Comte and Whewell. The writer would merely remark that in the degree in which the reasoning faculty is developed on this planet, and is exercised by our species, it appears to be a more healthy and normal condition of such faculty,—certainly one which has been productive of most accession to truths, as exemplified in the mental workings of an Aristotle, a Galen, a Harvey, and a Cuvier,—to admit the instinctive impression of a design or purpose in such structures as the valves of the vascular system and the dioptric mechanism of the eye. In regard to the few intellects—they have ever been a small and unfruitful minority—who do not receive that impression and will not admit the validity or existence of final causes in physiology, the writer has elsewhere expressed his belief that such intellects are not the higher and more normal examples, but rather manifest some, perhaps congenital, defect of mind, allied or analogous to 'colour-blindness' through defect of the optic nerve, or the inaudibleness of notes above a certain pitch through defect of the acoustic nerve."—Owen, *Palæontology*, p. 313.

9.—"If chance hath formerly produced such things, how comes it that it doth not sometimes now produce the like? Whence becomes it, for so many ages altogether impotent and idle? Is it not the same kind of cause; hath it not the same instruments to work with, and the same materials to work upon? The truth is, as it doth not now, so it did not, and never could, produce such effects. They are plainly improper and incongruous to such a cause. Chance never

writ a legible book; chance never built a fair house; chance never drew a neat picture; it never did any of these things, nor ever will, nor can, without absurdity, be supposed able to do them, which yet are works very gross and rude, very easy and feasible, as it were, in comparison to the production of a flower or a tree."—Barrow, *Sermons on the Creed, Serm. VI.*

10.—"The stone doth not deliberate whether it shall descend, nor the wheat take counsel whether or not it shall grow. Even men do not advise how their hearts shall beat, though without that pulse they cannot live. What then can be more clear than that those natural agents which work constantly, *for those ends which they themselves cannot perceive*, must be directed by some high and over-ruling wisdom, and who is that but the great Artificer who works in all of them? For art is so far the imitation of nature that, if it were not in the artificer but in the thing itself which by art is framed, the two were one and the same. Were that which frames a watch within it, and all those curious wheels wrought without the hand of man, it would seem to *grow* into that form, nor would there be any distinction between the making of that watch, and the growing of a plant.* Now what the artificer is to works of art, that is the Maker of all things to all natural agents; directing all their operations to ends which they cannot apprehend; and thus appears the Maker to be the Ruler of the world, the Steerer of this great ship, the Law of this universal commonwealth, the General of all the hosts of heaven and earth. For, as 'every house is builded by some man,' and the earth *bears no such creature of itself;* stones do not grow into a wall, or first hew and square, then unite and fasten themselves together; trees sprout not cross like dry and sapless beams, nor spars and tiles arrange themselves into a roof; as these are the supplies of art, and testimonies to the understanding of man, the great artificer on earth, so is the world itself but a house, the habitation and the handiwork of an Infinite Intelligence, and 'He who built all things is God.'"—Pearson *On the Creed*, Art. I.

* Paley's celebrated illustration was probably suggested by this passage.

C.

ON INSTINCT GENERALLY CONSIDERED.

The following remarks on Mr. Darwin's Chapter on Instinct are published here by permission of the able and eminent scholar to whom I am indebted for them :—

"There is a good deal of confusion through the chapter on Instinct between *instincts* and *habits*. It strikes me that the differences between wild and domestic animals belong to the head of habits, not of instincts ; *i.e.* such habits as may confessedly become hereditary. It is by laws identical with those of habit that man has imposed peculiarities, to suit his own purposes, on many classes of domesticated creatures : but I can see no explanation that could be given for the superiority of the hive-bee's architecture over that of the melipona which would be analogous to the influence of man's company and authority over the different habits of the domestic dog.

"But do we get any nearer to a definition of instinct if we call it *congenital* habit : *i.e.* habit which has not become hereditary by mere exception to the generally *personal* character of habits, but which is hereditary by its very essence and necessity ? This is more like his meaning, I fancy : and this adjective *congenital* would enable us to divide the subject into two convenient heads : it would confine the analogy to *present definition*, while implying that the *mode of production* is not the same : the very distinction which he seems to urge.

"How then does he defend his new account of the *mode* in which instincts were *produced*, before they became hereditary and congenital ? Believers say that they were impressed by God on the species which He independently created. Darwin says, that they sprang from a *small* dose of habit, plus a much *larger* dose of natural selection, and extended more to the individual than to the class. Now this cannot be proved, unless he can catch, *in transitu*, some indications of the process he describes. If he soars into the "great might—have—been," he must at any rate give us plenty of *frontier* or *travelling* instances to prove the correctness of the *direction* of his flight. This he is conscious of, and this he aims at : but not, as I think, with much success.

"In this chapter, as throughout the book, he is hampered by the absence of any *present movement* in the direction he requires. His

gradations are *collateral*, not *successive*: and I don't see what right he has to argue from the one to the other. Species may fade into species, by a fair arrangement, which binds the whole world in one well-ordered chain. Natural theologians have treated this proximity of type as the impress and proof of one great Creating Mind. But it is quite a different thing to admit a theory, which would simply lift up out of the mass the most rudimental extreme, and transfer it back to a remote antiquity, alleging that all the more perfect forms, which now stand side by side, in contemporary order, represent successive links in a series of progressive improvements.

"He may well be ample in his demands for time; but they are vain unless you can detect a *present* tendency to move. No time is long enough to turn stagnation into movement. If two species have run on strictly parallel lines ever since the date of the earliest recorded observation, no amount of time that he could postulate would make it more likely that they should converge. It is futile to promise that, if only you are allowed a sufficient length of radius, a given line shall sweep round into a circle, while the line in question will not betray, even to the most delicate instrument, the faintest approximation to a curve.

"In mankind, again, you have movement proved by history. In animals, so far as I know, (excepting what *man* has imposed) you have none. The horse Copenhagen and the horse Bucephalus would stand very much on the same level: but in point of general culture, there was a good deal of difference between their respective masters.

"As to his suggestions for the possible *starting-points* of instinct, they convey to my mind no kind of conviction. I should not care to argue the case of the pointer, because that may be, for aught I know, a mere instance of hereditary habit. It is not an uncontrolled and unaccountable instinct, like that of the cell-building bee. Nor *could* I argue the case of the slave-making ants, because I am not sure how far we are safe in arguing from supposed analogies between the curious proceedings of those insects, and the social vices of mankind. But as to the hive-bee, which is obviously the crucial instance, he seems really to offer no account at all. What he says with so much detail and minuteness merely amounts to this: that those economical bees, which, by a mechanical accident, happened to have made the most of their honey, came, by the law of natural selection, to supersede all less lucky bees, and ultimately to constitute the class. Add to this, that the perpetuation of the instinct is burthened by the really hope-

less difficulty about the sterile workers, which makes it necessary to throw back the power of producing this improved and thrifty race, on the less gifted but parturient bees."

"When we attentively consider the habits of these articulated animals, we find that their actions, though evidently directed to the attainment of certain ends, are very far from being of the same spontaneous nature, or from possessing the same designed adaptation of means to ends, as those performed by ourselves, or by the more intelligent vertebrata, under like circumstances. We judge of this by their unvarying character,—the different individuals of the same species executing precisely the same movements, when the circumstances are the same; and by the very elaborate nature of the mental operations which would be required, in many instances, to arrive at the like results by an effort of reason. Of such we cannot have a more remarkable example than is to be found in the operations of bees, wasps, and other social insects; which construct habitations for themselves, upon a plan which the most enlightened human intelligence, working according to the most refined geometrical principles, could not surpass; but which yet do so without education communicated by their parents, or progressive attempts of their own, and with no trace of hesitation, confusion, or interruption, the different individuals of a community, all labouring effectively to one purpose, because their automatic impulses (from which their instinctive actions proceed) are all of the same nature. . . . . Although bees display the greatest art in the construction of their habitations, and execute a variety of curious contrivances, beautifully adapted to variations in their circumstances, the constancy with which individuals and communities will act alike under the same conditions appears to preclude the idea of their possessing any inherent power of spontaneously departing from the line of action, to which they are tied down by the constitution of their Nervous System. We do not find one individual or one community clever, and another stupid; nor do we ever witness a disagreement, or any appearance of indecision, as to the course of action to be pursued by the several members of any republic. The actions of all tend to one common end, simply because they are performed in respondence to impulses which all alike share. For a bee to be destitute of its peculiar tendency

to build at certain angles would be as remarkable as for a human being to be destitute of the desire to eat when his system should require food."—Carpenter's *Principles of Comparative Physiology*, Sec. 651, 681, Note.

D.

ON THE GEOMETRY OF THE BEE-HIVE.

I am favoured by Professor Kelland with the following :—

"If I had been asked *this* question—'What is the *lesson* from which the Bee has become so perfect a worker? Is it the experience of a saving of wax?' my answer would certainly have been that it is not. In any cells which I have seen, there *appears* some little slovenliness about the finishings, which strikes me as inconsistent with the supposition that the animal has at heart the necessity for economy. But I may be mistaken in this. At any rate, I cannot be mistaken in the remarkable fact that the creature works always so as to make the *angles* equal. The terminal prismatic faces of the comb have the remarkable property that *each* of the solid angles is formed of three equal angles. Now, I cannot regard this power of selecting equality of angles other than as a simple endowment direct from the Divine Mind, and the *result* is economy and all the benefits which we, the learners in the school of *experience*, find to accompany this simple instinct.

"As to Mr. Darwin's argument on this head having shaken the impression of a Divine Orderer, I cannot see how it even *tends* to do so. Admit, for the sake of argument, that a circle-maker rises up to a hexagon-maker, are you freed from the necessity of the framer of the *power* of rising?"

"The work of bees is among the most remarkable of all facts. The form is in every country the same—the proportions accurately alike—the size the very same to the fraction of a line, go where you

will; and the form is proved to be that which the most refined analysis has enabled mathematicians to discover as of all others the best adapted for the purposes of saving room, and work, and materials. This discovery was only made about a century ago; nay, the instrument that enabled us to find it out—the fluctional calculus—was unknown half a century before that application of its powers.

"And yet the bee had been for thousands of years, in all countries, unerringly working according to this fixed rule, not only choosing the same exact angle of 120 degrees for the inclination of the sides of its little room, which every one had for ages before known to be the best possible angle, but also choosing the same exact angles of 110 and 70 degrees for the inclinations of the roof, which no one had ever discovered till the eighteenth century, when Maclaurin solved that most curious problem of *maxima* and *minima*, the means of investigating which had not existed till the century before, when Newton invented the calculus whereby such problems can now be easily worked."—Brougham, *Nat. Theol.*, Part I., Sec. iii.

"If you have a certain space, as a room, to build up closets or little cells, all of the same size and shape, there are only three figures which will answer, and enable you to fill the room without losing any space between the cells. They must either be square or figures of three equal sides, or figures of six equal sides. With any other figures whatever, space would be lost between the cells. This is evidently true upon considering the matter; and it is proved by mathematical reasoning. The six-sided figure is by far the most convenient of these three shapes, because its corners are flatter, and any round body placed in it has therefore more space, there being less room lost in the corners. Likewise this figure is the strongest of the three; any pressure either from without or from within will hurt it less, as it has something of the strength of an arch. A round figure would be still stronger, but then room would be lost between the circles, whereas none at all is lost with the six-sided figure. Now, it is a most remarkable fact, that bees build their cells exactly in this shape, and thereby save both room and materials beyond what they would save if they had built in any other shape whatever. They build in the very best possible shape for their purpose, which is

to save all the room and all the wax they can. So far as to the shape of the walls of each cell; but the roof and floor, or top and bottom, are built on equally true principles. It is proved by mathematicians that to give the greatest strength, and save the most room, the roof and floor must be made of three square planes meeting in a point; and they have further proved, by a demonstration belonging to the higher parts of Algebra, that there is one particular angle or inclination of those planes to each other where they meet, which makes a greater saving of materials and work than any other inclination whatever could possibly do. Now, the bees actually make the tops and bottoms of their cells of three planes meeting in a point, and the inclination or angle at which they meet is precisely the one found out by the mathematicians to be the best possible for saving wax and work. Who would dream for an instant of the bee knowing the highest branches of mathematics—the fruits of Newton's most wonderful discovery—a result, too, of which he was himself ignorant, one of his most celebrated followers having found it out? This little insect works with a truth and correctness which are quite perfect; and according to the principles at which man has only arrived after ages of slow improvement in the most difficult branch of the most difficult science. But the mighty and all-wise Creator, who made the insect and the philosopher, bestowing reason on the latter, and giving the former to work without it—to Him all truths are known from all eternity, with an intuition that mocks even the conceptions of the sagest of mankind."—Conybeare, *Theological Lectures*, Appendix.

E.

ON THE HUMAN EYE.

"Natural selection will not produce absolute perfection. . . . The correction for the aberration of light is said, on high authority, not to be perfect even in that most perfect organ, the eye."—*Origin of Species*, Chap. vi.

It is no small privilege to be enabled, by the courtesy of Sir David Brewster, to oppose to this statement an effectual

antidote from the *highest* authority in the science of Optics since the days of Newton.

"It is true that the correction for the aberration of colour is not perfect in the Human Eye; but *vision* is notwithstanding perfect, and, therefore, as the organ of vision, the Eye is perfect.

"The uncorrected colour is not seen, but is discovered by looking through the edge of the pupil, or the edge of the crystalline lens; and the existence of the colour, or rather the evidence of the Eye not being perfectly achromatic, may be obtained by showing that the foci for Blue and Red light are not coincident.

"As the achromatism of the Eye is not necessary for *perfect* vision, the argument for Design is increased rather than abated; as there is as much of what is admirable in the economy as in the abundance of Creative Wisdom.

"There is nothing in the organs of vision of the ower animals, in so far as I know, that countenances Mr. Darwin's views. On the contrary, animals of a low type have organs of vision of great beauty and perfection.

"On the subject of the uncorrected colour of the Human Eye, see the *London and Edinr. Philosoph. Mag.*, 1835, Vol. vi. pp. 161, 247." Also, Sir D. B.'s *Treatise on Optics*, p. 148.

. . . . . .

"We have in the first era of organic life animals of high organization, trilobites with the most perfect organs of sensation, and the cuttle-fish with an eyeball scarcely surpassed in beauty by the human organ." Article on "Vestiges," in *North Brit. Review*, Vol. III. p. 486. [Sir David permits me to mention that this article (referred to in Note 1) is by himself.]

F.

ON PARTHENOGENESIS, PROTOGENESIS, AND PALINGENESIS.

If all animals now living could be representatively catechized, and could tell us truly and fully *how they came to be alive*, we should doubtless have several kinds of answer. How many, and within what

formula comprehensible, is a deeply important investigation. For, if we are to assemble all hypotheses which are afloat, and which enjoy credit and currency in various degrees, from absolute certainty downwards, the forms of reply would be not fewer than the following :—

1. I am sprung from two *parents*.
2. I am sprung from two parent *principles*.
3. I am sprung from *one* or *two* parents whom I do not resemble, and I have children or grandchildren, who resemble *her*, or *them*, but do not resemble me.
4. I am *part* of my parent.
5. I had *no parent at all*.

The first would be the answer of all Vertebrate animals, and of all the higher Sub-vertebrates as well.

The second would be the answer of certain low Articulates, Hermaphrodite Radiates, &c.

The third would be the answer, *e.g.*, of the Salpa, a Molluscous animal, the Aphis, the polype-born Medusa, &c.

The fourth would be the answer of sundry protozoic animalcules, as *Vorticella* or *Leucophrys*, owing their individuality to self-partition or 'spontaneous fission.'*

The fifth would be the answer, were M. Pouchet their spokesman, of those minute beings which he believes himself to have traced to 'spontaneous generation.'†

I.—With the two first answers we have here no concern. They are really one answer under two forms. The male and female principle—'sperm-cell' and 'germ-cell'—are equally assumed in both. Distributed or combined, both sexes are represented. This is ordinary generation, or GENESIS.

II.—The third answer introduces us to the hitherto unfamiliar and as yet debated phenomena called by the Danish Professor Steenstrup the 'alternation of generations,' but to which Professor Owen has given the more descriptive name of PARTHENOGENESIS.

By "debated" it is not meant that there is any doubt as to the *facts* on which these names are founded : the only doubt is as to the character and construction of these facts—the *category* to which they ought to be referred.

* J. Müller's *Elements of Physiology*, Bk. VII. Sec. I. ch. ii. Roget's *Animal and Vegetable Physiology*, Vol. I. p. 584. Owen's *Parthenogenesis*, p. 9.

† *Hétérogénie*, Paris, 1859.

The examples named above are *Salpa*, *Aphis*, *Medusa*. For the phenomena, though analogous, are multiform.

"The generations of the *Salpæ* are alternately solitary and associated [Salpa-chains], so that a Salpa mother, to use Chamisso's familiar expression, is not like its daughter or its own mother, but resembles its sister, its grand-daughter, and its grandmother." (Steenstrup, *Alternation*, &c., Ray Society, p. 39.) Among Radiates, a rooted or plant-like polype *(Campanularia dichotoma)* giving birth ordinarily to other polypes like itself, produces occasionally a free-swimming sea-jelly (Bell-Medusa) which, however, instead of producing other Medusæ, reproduces its polype-parent in its own progeny.—*(Parthenogen*, p. 11.) Once more, among Articulates, (for the phenomenon is peculiar to the Sub-vertebrate types) *Aphis*—male and female—leaves a fertilized ovum at the close of Summer which becomes a wingless larva in Spring. This larva produces other larvæ *of itself*, which go on *of themselves* producing other larvæ, till after, it may be, a dozen 'generations,' winged males and perfect females reappear, and the animal cycle is re-enacted. Thus the spermatic power energizes in this insect in a way that reminds us of a sharp-edged stone grazing the surface of a stream, and skipping as it skims till the impetus is spent. These examples may suffice. They may all be considered as instances of *parenthetic* procreation. The parenthesis may be *ascensive* (as in the radiate Medusa) or *descensive* (as in the articulate *Aphis)*, or much on the same level (as in the Molluscan *Salpa)*. But they all express themselves by a formula similar in its terminal characters, and which may be exhibited thus :—

A (b b b) A. *Aphis*, &c.
A (b) A. *Salpa*, &c.
A (b c d) A. *Medusa*, &c.

Such the phenomena : how are they to be interpreted ? Is this generation, or merely gemmation or budding—a simply *pro*ductive or a strictly *re*productive process ? Those who wish to possess themselves of the argument on one side may consult the "Parthenogenesis" of our great philosophical anatomist. On the other hand, Dr. Carpenter *(Principles of Physiology*, p. 528) prefers to "include under the title of *one generation* all that intervenes between one generative act and the next. If the phenomena (continues he) be viewed under this aspect, it will be obvious that the so-called 'alternation of generations' has no real existence, since in any case the whole series of forms which is evolved by continuous development from one generative act

repeats itself precisely in the product of the next generative act." (See also p. 573.)

However interesting physiologically, and also in another light, this discussion may be, it is only necessary to observe here (1.) That Parthenogenesis is no infraction on the law of Genesis proper: under either construction the parenthetic progeny is only *apparently* due, in any case, to one parent, but, *really* due to both: in combined 'sperm-cell' and 'germ-cell' the process opens, in replaced 'sperm-cell' and 'germ-cell' the process ends. (2.) Parthenogenesis lends no shadow of support to 'Development.' The series returns into itself: "the cycle is definitely closed." (Owen.)

Hitherto, then, we have discovered no departure from the great law of Bisexual Parentage—"Omne vivum ex ovo."

III.—But our fourth answer brings us a veritable exception to it. Our infusorial catechumen is speaking (as seems) the truth. Strictly, *Vorticella* (or the like) is a species composed of one divided individual—self-partitioned *ad infinitum*, with all his ancient parts dead, and all his recent parts living! (*Parthenogen.* p. 36.)

Waiving, however, this quaint exactitude of conception, we may consider living "vorticellæ" as *children* of the dead—last year's "vorticellæ" as ancestors, this year's as posterity. In which case, though the parentage is now Unisexual or Non-sexual, we are still beneath the sway of the law of Parentage: no life save from a living predecessor: "Omne vivum ex *vivo*." The tree is parent to the bud, and this is budding: only trees do not bud, like the animalcule, by splitting spontaneously into two.* It might, therefore, be desirable to have a distinct name, analogically formed, for this simplest form of protozoic propagation, *e.g.* PROTOGENESIS.

IV.—But is it the simplest? This, in common with former advocates of spontaneous generation, M. Pouchet denies. Not only, he holds, are ova *homo*geneously generated—"like begets like"; they may be, and have been, *hetero*geneously produced, *a.* from the living organism in the form of parasites; or, *b.* from putrescent organic matter —"corruptio unius generatio alterius"; or even, *c.* from inorganic elements.

This view—which embodies the fifth of our supposed answers

* Budding therefore (Phytogenesis?) is merely a restricted and enfeebled form of Protogenesis, involving the curtailment of the parent organism, but not, as among the Infusoria, bi-partition or suicide.

—is *Heterogenesis.* Life, according to M. Pouchet, is non-parentally producible by natural laws.

That an immensely significant issue is thus seemingly raised afresh, is a consideration which must be rigidly dismissed from the scrutiny of the evidence, and not suffered in any way to bias the verdict.

It is necessary, however, on the very threshold, to purge the issue from all ambiguity.

M. Pouchet's doctrine is complex; *a.* or *b.*, or both, might be true, and yet *c.* might be false.

This premised, it is worth while to bear in mind that *a.* or *b.*, or both, differ from *c.* in this, that they *presuppose organization.* A parasite implies an animal to lodge in. A decaying organism means death; and death means previous life. An animal directly generated from either a living body, or a "corps putrescible," depends therefore for its production on antecedent vitality. Life, in one sense, would still beget life; contemporaneously in the case of the parasite, posthumously in the case of the supposed offspring of putrescence. *Heterogenesis* is therefore only applicable, in strict propriety, to the case of *c.*; the asserted power of the inorganic mineral to initiate the germ of organic animal or plant. For the processes defined by *a.* and *b.*, the true term is PALINGENESIS, or *re*vivification Were this proved to-morrow, notwithstanding, a Creator *to initiate life* would be as indispensable as ever. Occult powers would indeed be brought to light; but the maxim "Omne vivum ex vivo" would not be upset:—it would only have to be construed so as to include what *had* lived as well as what was actually living. The question would still press—Whence the strictly pristine vitality?

Grasping this distinction firmly, it may briefly be observed, that whether living tissues breed parentless parasites, or *de*composing tissues *re*compose into microscopic ova, is, at the utmost, the rational *limit* of inquiry. It is true that even Palingenesis is supremely improbable;* but Heterogenesis as above defined—life by law out of

* M. Pouchet's experiments are the subjects of two masterly articles in Blackwood and the British Quarterly (February and January, 1861). "Not proven and improbable" is the conclusion of both writers. To these testimonies may be added the high authority of Dr. Carpenter—"It may be considered as a fundamental truth of physiological science, *that every living organism has had its origin in a pre-existing organism.* The doctrine of spontaneous generation, or the supposed origination of organized structures, *de novo*, out of assemblages of inorganic particles, although at

matter that was never alive—is an alchemist's dream. M. Pouchet, after describing with unconscious yet admirable precision (p. 503) the Darwinian doctrine as yet unborn on this side the Channel, pronounces it unworthy of serious scrutiny, and classes it with other products of a "delirious imagination." When the author of the "Origin of Species" glances at the pictured *olla podrida* of the cataclysms (p. 494) he may nevertheless afford a smile; for in perusing the previous assertion of the life-producing virtue "inhérente a l'eau" (p. 223) he has doubtless felt himself avenged. How could even *Volvox* be evolved from the grim and barren womb of pulverized granite and water!

G.

ON THE HUMAN AND BRUTE BRAINS.

I have Professor Owen's kind permission to enrich these pages with the following observations, the value of which will be understood by those who may have glanced at a paper on the "Relation of Man to the Lower Animals," in No. I. of the newly-started "Natural History Review."

"The part called 'posterior lobe' in the human brain has no natural division from the rest of the convoluted hemisphere, and consequently is not precisely defined in Human Anatomy. Todd in his excellent article, 'Nervous Centres,' in the 'Cyclopædia of Ana-

different times sustained with a considerable show of argument, based on a specious array of facts, *cannot now be said to have any claim whatever to be received as even a possible hypothesis;* all the facts on which it claimed to rest, having either been themselves disproved, or having been found satisfactorily explicable on the general principle, *Omne vivum ex ovo*. Thus the appearance of animalcules in infusions of decaying organic matter, the springing up of fungi in spots to which it would not have been supposed that their germs could have been conveyed, the occurrence of Entozoa in the bodies of various animals into which it seemed almost beyond possibility that their eggs could have been introduced, with other facts of a like nature, may now be accounted for, without any violation of probability, by our increased knowledge of the mode in which these organisms are propagated."

tomy,' says the *middle lobes* 'have no exact boundary behind, but pass off very gradually into the *posterior lobes* of the hemispheres.' *Vol.* iii. *p.* 672. But Comparative Anatomy affords a definition based on the relative position of the back part of the cerebrum to the cerebellum. The part of the former 'which covers the posterior third of the cerebellum and extends beyond it' is the 'posterior' or third lobe; and it makes its appearance suddenly with the concomitant vertical and lateral vast expanse of the convoluted hemispheres in man. There is no 'third lobe,' according to the above definition, in any Ape.

"Into the 'third lobe' in the human brain is prolonged the part of the lateral ventricle called the 'posterior cornu,' defined by Todd as 'turning inward towards that of the opposite side'; this part I find only in the human brain, together with its concomitant internal fold of cerebral matter called 'hippocampus minor.' In the brain of the Chimpanzee and Orang, there may be said to be a beginning of the 'posterior cornu,' with a prominence in it which has been called the 'pes hippocampi minoris,' *i. e.* the foot or base of that prominence; but the true posterior horn and its proper convolution exist only in man. The back part of the hemisphere has been called the 'posterior lobe,' by myself and others, in many lower animals, before the definition from relative position to the cerebellum was published, and incorrectly agreeably to it. It is only according to that definition—an artificial one, yet the best I believe that the nature of the part permits—that I have spoken of the brain of man in the characters of the *Gyrencephala* in the 'Reade's Lecture on the Classification of the Mammalia,' 8vo. 1859, p. 25.

"All this matter was very fully discussed at the Linnæan Society in 1857, when I submitted to my fellow-labourers in Comparative Anatomy the grounds which the differences of cerebral structure seemed to afford for a more natural primary division of the class mammalia than had before been adopted. Meyer's assertion, *e. g.* that the Kangaroo had a 'corpus callosum' in its brain, was quoted as opposing the character expressed by the term *Lyencephala*. But it was admitted, at best, that the part so called was but a mere beginning of the 'corpus callosum'; and there are Comparative Anatomists who do not admit the right of the part in question, viz. the thickened forepart of the 'fornix,' to be so called. But the undisputed point, and main point with me, was the sudden appearance of a true *corpus callosum* in the Jerboa as contrasted with the Kangaroo, and in the Beaver as contrasted with the Wombat; a great stride in cerebral develop-

ment beyond question or cavil. So it is, likewise, in respect of the back part of the cerebrum, as between man and the best-brained *Gyrencephala*. Some may continue to dispute about the 'rudiment,' but more properly beginning, of a third lobe, or of a posterior cornu, and a hippocampus minor; but there is no question or ground for cavil in respect to the sudden and great development which issues in the sole appearance, in man, of the parts defined in Anthropotomy as 'posterior cornu' of the lateral ventricles with the 'hippocampus minor,' which are entirely due to the production of a 'third lobe,' according to the definition from relative position. On the grounds, therefore, that I have divided the 'Lyencephala' from the 'Lissencephala,' I have also divided the 'Archencephala' from the 'Gyrencephala.'

"Perfect natural demarcations of secondary groups in Zoology are extremely rare.

"The transition from the 'Lissencephala' to the smallest species of 'Gyrencephala' is closer than between the other primary cerebral groups.*

"No science affords more scope or easier ground for the caviller and controversialist; and these do good by preventing scholars from giving more force to generalisations than the master propounding them does, or meant his readers or hearers to give."

"It has been calculated by naturalists that in the vertebrata the brain in the class of fishes bears an average proportion to the spinal cord of about two to one; in the class of reptiles, of about two and a-half to one; in the class of birds, of about three to one; in the class of mammals, of about four to one; and in the high-placed, sceptre-bearing ['archencephalic'] human family a proportion of not less than *twenty-three* to one."—Hugh Miller, *Footprints*, p. 143.

It may be added, to avoid over-statement and forestall objections, that if the relative mass of the *highest* brute-brain

* The closer affinity above pointed out between the Gyr- and Liss-encephala, or 'Commissure-Brained' Mammalia, *inter se*, as opposed to the Lyencephala, or 'Non-Commissured,' may be compared with the similarly closer affinity (already alluded to —p. 143—as illustrating the conformity to the truth of nature of Gen. i. 20-22) of the Sanguitard Fish-Reptile classes as opposed to the warm-blooded "winged Fowl."—Compare 1 Cor. xv. 39.

be denoted by 2, that of the *lowest* human brain will be denoted by 5; and that the variations in volume within the limits of the human race range as from 2 to 3.

H.

ON THE DEVOTION OF THE LOWER ANIMALS TO MAN.

"Take an example of a dog, and mark what a generosity and courage he will put on when he finds himself maintained by a man who to him is instead of a God, or *melior natura*—which courage is manifestly such as that creature without that confidence [firm belief] of a better nature than his own, could never attain. So man, when he resteth and assureth himself upon divine protection and favour, gathereth a force and faith which human nature in itself could not obtain; therefore as atheism is in all respects hateful, so in this, that it depriveth human nature of the means to exalt itself above human frailty." (See Bacon, *Essay* xvi., in the valuable edition of Archbishop Whately.)

As at once illustrating and qualifying this noble passage, the reader may remember the verses in which Wordsworth has embalmed "FIDELITY."

. . . .

From those abrupt and perilous rocks
The Man had fallen, that place of fear!
At length upon the shepherd's mind
It breaks, and all is clear:
He instantly recalled the name,
And who he was, and whence he came;
Remembered too the very day
On which the traveller passed this way.

But hear a wonder, for whose sake
This lamentable tale I tell!

A lasting monument of words
This wonder merits well.
The Dog, which still was hovering nigh,
Repeating the same timid cry,
This Dog had been, through three months' space,
A dweller in that savage place.

Yes ! proof was plain that since the day
When this ill-fated traveller died,
The Dog had watched about the spot,
Or by his master's side :
How nourished here through such long time
He knows who gave that love sublime,
And gave that strength of feeling, great
Above all human estimate !

NOTES AND REFERENCES.

1. It is sufficient to refer to the masterly critique on the "Vestiges" by Sir David Brewster in Vol. III. of the *North British Review*, and to the thoughtful and suggestive work of Drs. MacCosh and Dickie, "Typical Forms and Special Ends in Creation." (Edinr. Constable, 1856.)

2. Mr. Baden Powell, *Essays and Reviews*, p. 139.

3. Owen, *Reade Lecture*, 1859 : Appendix.

4. Since the above was written, it appears from a note in Professor Phillips' *Life on the Earth* (Reade Lecture, 1860), p. 203, that we may hope for such from Professor Sedgwick.

5. *Origin of Species*, pp. 484—490.

6. *Id.* p. 40.

7. *Cornhill Magazine*, March, 1860.

8. Genesis xxx. 37—43.

9. *Origin of Species*, p. 31.

10. *Id.* p. 22. Compare, however, Lyell, *Principles of Geology*, Bk. III. ch. ii.

11. See, for example, Hugh Miller's description of the "Lias of Eathie."—The almost infinitesimal results of the attacks of the sea on the dry land have furnished mankind, since poetry began, with their stock image at once for fierce *impetuosity* and fierce *futility*. The former is the idea in the noble lines of the Iliad (IV. 425—428) thus finely rendered by Mr. Gladstone :—

> As when the billow gathers fast
> With slow and sullen roar
> Beneath the keen north-western blast
> Against the sounding shore ;

First far at sea it rears its crest,
  Then bursts upon the beach,
Or, with proud arch and swelling breast,
  Where headlands outward reach,
It smites their strength, and bellowing flings
  Its silver foam afar;
So, stern and thick, the Danaan kings
  And soldiers marched to war.

—*Translations*, 1861.

Horace paints the *imbecility* of the sea with one of his wonderful master-strokes :—

Seu plures hiemes, seu tribuit Jupiter ultimam
Quæ nunc oppositis *debilitat* pumicibus mare
Tyrrhenum. *

—*Carm.* I. xi.

12. See *Principles of Geology*, Bk. II. chapters v. and vi.; and *Life on the Earth*, p. 126, &c.

13. A recent writer, Mr. Mackie, *First Traces of Life on the Earth*, allows only *three* inches for ten thousand years; which would give us 40,000 multiplied by 80,000, as the age in years of the sedimentary strata!

14. *Life on the Earth*, p. 130.

15. See Lyell, Bk. III. ch. iii.—"Notwithstanding the variety of forms presented by the several races of Dogs, we never see any which present so strong a resemblance to a Fox as to be at all in danger of being mistaken for that animal; and they may always be distinguished by this obvious character—that the *pupil* of the eye of the Dog is always round whilst that of the Fox is oval when contracted."—Carpenter's *Zoology*, Vol. I. p. 33.

* 'Tis impious: seek not thou to know
  The doom that waits thyself or me:
Chaldea's mystic art forego,
  Inquisitive Leuconoé!

'Tis better far in peace to bide
  Whate'er may be for each in store;
To take content whate'er betide,
  Yet not to feel the ill before:

Whether the winter be our last
  That shatters on the unshrinking shore
The billow maddened by the blast,
  Or Heaven in kindness wills us more:

&c.

16. The reversal of opinion in a trial for murder which resulted from the inspection of the blood-stains by Orfila is a remarkable illustration of this.

17. See *Westminster Review* on "Origin of Species" for one detailed example.

18. Prichard, *Natural History of Man*, p. 36.

19. *Id.* p. 29.

20. *Id.* p. 34.

21. *Origin of Species*, p. 31.

22. Pickering's *Races of Man*, Introduction, p. 53. Compare Lyell, Bk. III. ch. iv.

23. See an able Paper by Mr. Hopkins, in *Fraser's Magazine*, July, 1860.

24. See a Paper by Mr. Murray, in Edinburgh *New Philosophical Journal*, January, 1860. M. Pouchet, when not under the dominion of his favourite idea, writes like a man of science and sense; and he puts the argument from *Habitat* very forcibly: "Le Fourmilier-tamanoir, par exemple, n'a jamais pu nâitre dans l'ancien monde, pour s'en expatrier ensuite et aller se fixer dans les brûlantes régions de l' Amérique méridīonale!"—*Hétérogénie*, pp. 499—501.

25. Cuvier asserts this in the most absolute terms in his "Tableau Elémentaire" of Natural History. "How different soever they be, they are *always* able to interbreed"—"peuvent *toujours* produire ensemble." See *Edinburgh Review*, No. 226.

26. Whewell's *Philosophy of the Inductive Sciences*, Vol. I. p. 506. See also a striking passage from Professor E. Forbes, in Balfour's *Class Book of Botany*, p. 710—"An individual is one; a species consists of many resulting from one; a genus consists of more or fewer of these manies, linked together not by a relationship of descent, but by an affinity dependent on a Divine idea. . . . What we call class, order, family, genus, are all only so many names for genera of various degrees of extent."

27. *Origin of Species*, p. 50.

28. *Id.* pp. 26, 252.

29. Juvenal, *Sat.* XIII. 66.

30. *Westminster Review* on "Origin of Species."

31. "Geology indeed seems to have left her old handmaiden mineralogy, to rest almost wholly upon her young and vigorous offspring, the science of organic remains."—Owen, *Palæontology*, p. 2.

32. *Siluria*, p. 20. *Life on the Earth*, pp. 68, 214. Hugh Miller, *Footprints of the Creator*, pp. 216—220.

33. Hugh Miller.

34. *Origin of Species*, pp. 307, 308.

35. *Westminster Review* on "Origin of Species."

36. *Footprints*, p. 237.

37. Owen, *Reade Lecture*, p. 59.

38. Bede, *Eccles. Hist.* L. II. c. xiii.

39. *Life on the Earth*, p. 84.

40. *Palæontology*, p. 151.

41. *Siluria*, p. 269. *Footprints*, p. 124. *Palæontology*, p. 102.

42. This felicitous expression is due to an American writer, *Dr. Clemens.*

43. Report of the French Savans, headed by Cuvier, on the animal remains sent to France from Egypt. Lyell, Bk. III. ch. ii.

44. Dasent, *Norse Legends*, Introduction.

45. Herodotus, II. 68—73.

46. *Life on the Earth*, p. 46.

47. *Id.* p. 21.

48. *Origin of Species*, p. 83.

49. Psalm CIV. "It might almost be said that this one psalm represents the image of the whole Cosmos. We are astonished to find in a lyrical poem of such a limited compass, the whole universe—the heavens and the earth—sketched with a few bold touches. The contrast of the labour of man with the animal life of nature, and the image of Omnipresent Invisible Power, renewing the earth at will or sweeping it of inhabitants, is a grand and solemn poetical creation."—Humboldt, *Cosmos;* "Descriptions of Nature by the Hebrews." Vol. II. Part I.

50. *Footprints*, pp. 237, 258.

51. Owen, *Philosoph. Transactions* 1834, *Reade Lecture*, p. 29.

52. *Phil. Induct. Sciences*, Vol. I. p. 625.

53. Reade Lecture, p. 62. Also, *On the Nature of Limbs*, p. 84. "Our discovery of *laws* cannot contradict our persuasion of *ends*."—*Phil. Induct. Sciences*, Vol. I. p. 630.

54. *Id.* p. 621. Also, "Bridgewater Treatise," by the same author, Bk. III. ch. v.

55. Carpenter, *Principles of Physiology*, p. 328. *Life on the Earth*, pp. 37—39.

56. *Wisdom*, xiii. 5.

57. The phrase—a very suggestive one—is Theodore Parker's. *Theism*, &c. p. 197.

58. *Georgic.* IV. 219—224.

59. *Clouds*, 147—153.

60. Appendix C.

61. *Origin of Species*, p. 242.

62. Pope, *Essay on Man.*

63. *Edinburgh Review*, Vol. CXI. p. 520.

64. "Simia quam similis turpissima bestia nobis."—*De Nat. Deor.* I. xxxv.

65. Carpenter, *Zoology*, I. p. 137.

66. *Reade Lecture*, p. 70. Compare Du Chaillou's description of the Male Gorilla, and an interesting sketch a few years ago in "Household Words."

67. *Reade Lecture*, p. 48.

68. *Origin of Species*, p. 481.

69. Frederick Robertson, Vol. I. p. 189.

70. Prichard, *Nat. Hist. of Man*, Sect. II.

71. "Quis nescit, Volusi Bithynice, qualia demens
Aegyptus portenta colat?" &c.
—Juvenal, *Sat.* XV. 1—14.

> Who knows not, friend, what creatures odd and vile
> *Mad Egypt worships?* Some the crocodile
> Revere, and some the ibis. Others shape
> A god to please them in the grinning ape, &c.

"The poetical gods of Greece, . . *the animal worship of Egypt* . . all accompanied by systems of law and civil government . . *were the means of educating* these people to *similar purposes in the economy of Providence* to that for which the Hebrews were destined." —*Essays and Reviews*, p. 15. It were an absurdity to ask what St. Paul would have thought of this statement. Enough that, if it be true, the Hebrew light must have been darkness in comparison to that of the Roman satirist! Ape-worship still survives among the Hindoos. Why interfere with this part of their "providential education?" *

72. *Origin of Species*, p. 483.

73. Bacon, *Essays*, XVI. — Compare *De Augmentis*, Lib. III. cap. iv., and Dr. Whewell's "Bridgewater Treatise," p. 352.

74. Newton, *Opticks*, Query 28.

75. *Palæont*, pp. 406, 413.

76. *Origin of Species*, p. 484.

77. *Id.* pp. 481, 489.

78. Whewell, *Hist. of Induct. Sciences*, Vol. III. pp. 380, 388, 453.

79. To Linnæus is due the *name* and distinct demarcation of the Mammalia. Cicero had some perception, however, of the distinctive importance of this character:—"In iis animantibus *quæ lacte aluntur.*" —*De Nat. Deor.* II. li.

80. Of insects there are reckoned about half-a-million of *species;* and the individuals of this class alone would bear out to the letter the statement in the text. When we descend to the Protozoa, we are met by Professor Owen's calculation that 500 millions *might* be lodged in one drop of water!

* It is simple justice to the learned writer to state that his *meaning*, as gathered from the preceding context, is the reverse of this. But it is equally clear that the *language* above cited is so unfortunately chosen as not to *admit* of contextual qualification: it can only be mended by being cancelled. Ape-worship may be debasing and foolish idolatry: this is doubtless *meant*. But how can it be at the same time a providential education?

81. Vertebrate, Articulate, and Radiate are all names of symmetry: "Mollusk" is not, and suggests a table standing on three legs instead of four. Besides, it is as applicable, convention apart, to a "soft" earth-worm as to a "soft" snail. But surely the family of "Shell-clad Sub-vertebrates" is referable to some archetype, as the other groups are. Wordsworth, with the intuitive sagacity of genius of the first order, such as Goethe's and his own, seems to have seized the essence of that symmetry:

The CONVOLUTIONS of a smooth-lipped shell.*

The tendency to the coil or the spiral, or again to "neural flexure" or "hæmal flexure," in the anatomy of the interior, is comprehensively yet distinctly conveyed by this epithet—for which, perhaps, "Circumflect" might be a serviceable synonym. The word "Circumsect," used in the text as interchangeable with "Articulate," has the convenience of being free from applicability to the Vertebrate type, and of suggesting etymologically the affinity of the spider, the crab, and the worm to the great family of *in*sects, already known by a name thoroughly embedded in our language.

82. *Reade Lecture*, passim.

83. Yet none of these instances approach the following :—

The American whale-ship "Essex" sailed from Nantucket for the Pacific Ocean in August, 1819. Late in the fall of the same year, when in latitude 40 deg. of the South Pacific, a shoal of sperm-whales was discovered, and three boats were manned and sent in pursuit. The mate's boat was struck by one of them, and he was obliged

* . . . . . I have seen
A curious child, who dwelt upon a tract
Of inland ground, applying to his ear
The *convolutions* of a smooth-lipped shell;
To which, in silence hushed, his very soul
Listened intensely; and his countenance soon
Brightened with joy; for from within were heard
Murmurings, whereby the monitor expressed
Mysterious union with its native sea.
Even such a shell the universe itself
Is to the ear of Faith; and there are times,
I doubt not, when to you it doth impart
Authentic tidings of invisible things;
Of ebb and flow, and ever-during power,
And central peace, subsisting at the heart
Of endless agitation.

—*The Excursion*, Book IV.

to return to the ship, in order to repair the damage. While he was engaged in that work, a sperm-whale, judged to be eighty-five feet long, broke water about twenty rods from the ship, on her weather-bow. He was going at the rate of three knots an hour, and the ship at nearly the same rate, when he struck the bows of the vessel, just forward of her chains. At the shock produced by the collision of two such mighty pieces of matter in motion, the ship shook like a leaf. The seemingly malicious whale dived and passed under the ship, grazing her keel, and then appeared at about the distance of a ship's length, lashing the sea with fins and tail as if suffering the most horrible agony. He was evidently hurt by the collision, and blindly frantic with instinctive rage. In a few minutes he seemed to recover himself, and started with great speed directly across the vessel's course to windward. Meanwhile, the hands on board discovered the ship to be gradually settling close at the bows, and the pumps were ordered to be rigged. While working at them, one of the men cried out—"God have mercy! he comes again!" The whale had turned one hundred rods from the ship, and was making for her with double his former speed, his pathway white with foam. Rushing head on, he struck her again at the bow, and the tremendous blow stove her in. The whale dived under again and disappeared, and the ship filled and fell over on her broadside, in ten minutes from the first collision. After incredible hardships and sufferings, in their open boats, on the 20th December, the survivors of this catastrophe reached the low island called Ducies. . . . Out of a crew of twenty, five only survived to make the ear of the world tingle at their strange eventful story.

And we are to believe that this mighty embodiment of the Vertebrate Archetype is co-descended from the ancestor of the monad who shares with 500 millions of fellow-citizens a territory consisting of one drop of water!

84. The spider watching her eggs, says Dr. Carpenter, (*Physiol.* p. 608) "would die of hunger sooner than quit her post." And yet she has previously signalized her devotion by an attempt at killing her spouse, and eating him!—a fate from which he is only saved by flight, if saved at all.

85. "*Father* is derived from a root PA, which means, not to beget, but to protect, to support, to nourish. The father as genitor was called in Sanskrit ganitâr, but as protector and supporter of his offspring he was called pitâr. Hence in the Veda these two names are used together, in order to express the full idea of father. In a similar manner mâtar, mother, is joined with ganitrî, genetrix, which shows that the word mâtar must *soon have lost* its etymological meaning, and have become an expression of respect and endearment. For among the early Arians, mâtar had the meaning of maker from MA to fashion, and in this sense is used in the Veda as a masculine. . . . The mutual relation between brother and sister had been hallowed at an early period . . *bhratâr*, he who assists or carries; *swasar*, she who pleases or consoles. . . . *Duhitar* is derived from DUH, to

milk. It is perhaps the Latin dūco, and the transition of meaning would be the same as between trahere, to draw, and traire, to milk. Now the name of milkmaid, [yet drawer of suck from *her own* mother =nursling?] given to the daughter of the house, opens before our eyes a little idyll of the poetical and pastoral life of the early Arians. One of the few things by which the daughter, before she was married, might make herself useful in a nomadic household, was the milking of the cattle; and it discloses a kind of delicacy and humour, even in the rudest state of society, if we imagine a father calling his daughter his little milkmaid, rather than sutâ, his begotten, or filia, the suckling."—Mr. Max Müller, *Oxford Essays*, 1856, pp. 14—17.

86. See "Natural History Review," January, 1861, and Appendix G.

87. "He (Mr. Max Müller) showed that though of late the line of demarcation between man and brute had been reduced to a mere fold in the brain, there was one barrier which even those philosophers would have to respect with whom *penser c'est sentir;* and that this barrier was Language."—Professor Max Müller on the Science of Language: *Saturday Review*, April 20, 1861. Was the Professor thinking of Pope?

'Twixt that and reason what a *nice barrier!*

Without under-rating the significance of language, we may remember that "a mere fold" is no correct expression, if literally construed, for the really vast physical chasm represented by an unbridged transition from the value expressed by 2 to that expressed by 5.—Appendix G.

88. "Animi imperio, corporis servitio magis utimur: *alterum nobis cum dīs*, alterum cum belluis commune est."—Sallust, *Bell. Catilin.* c. i.

89. This supposes the Animal Kingdom as contemplated in four *Groups*, of which Man is one. In the Linnæan arrangement, Man only represents the *genus* "Homo" of the order "Primates," in which he is associated with the genus "Simia." Cuvier secludes Man in his *order* "Bimana;" remanding the Ape tribe to a distinct order, "Quadrumana." Owen, deeming even this an insufficient indication of rank in the series, places Man in a *sub-class*, "Archencephala." Quatrefages goes far beyond this. "Adopting the ideas first enounced by several German authors, we will admit the existence of four *kingdoms* of nature—the Mineral, Vegetable, Animal, and

Hominal. Man is the exclusive representative of the last."—Quatrefages, "Rambles of a Naturalist," Translated by E. C. Otté, Longmans, Vol. I. Appendix I. It need scarcely be added that none of these modes of conceiving the relative rank of Man, physically considered, touches the *essence* of classification, as regards the forms below.

90. See generally, for striking analogies between the Organic Kingdoms, "Typical Forms and Special Ends in Creation." The writer had not made acquaintance with this valuable work when he sketched the parallelism in the text, nor was he aware that substantially the same idea had occurred to the French naturalist Dumortier. See note in Roget's *Animal and Vegetable Physiology*, Vol. I. p. 336. And compare the following :—

"In estimating their value, the characters of the classes are to be placed thus : 1. Wood [= vertebrate] ; 2. Embryo [= mammalia] ; 3. Leaves ; 4. Flowers. The structure of the wood is of more importance than all the others . . . the embryo than the leaves . . . the leaves than the flowers."—Lindley, *School Botany*, p. 23.

"Gymnogens are essentially Exogens in all that appertains to their organs of vegetation, . . but they are analogous to reptiles in the Animal Kingdom [that is, to the typical Sub-mammalian Vertebrate of the Mesozoic Fauna], inasmuch as their ova are fertilized" in the same manner.—Lindley, *Vegetable Kingdom*, p. 221. Compare Table I. p. 38.

In suggesting "Polypetalous," &c. in Table II. p. 89, as analogues to the cerebral graduation, I venture to follow (substantially) the French De Candolle, the German Endlicher, and our own Balfour, with Lindley himself (in his "School Botany"), although aware of the revision proposed by the latter in his larger work. For may not *Beauty* (conjointly with utility) as associated with the floral envelope, be truly the Creative goal in plants, even as *Sagacity* in the lower animals—essential perfection of Fabric and Reproductive System attained at previous stages in both ? See the noble Chapter (XI.) in the "Plurality of Worlds"—(Section 30) so instructive even to those who must dissent from the main idea of the work.

91. *Palæont*, pp. 312, 376, &c.

92. *Quarterly Review* (on Darwin), No. CCXV. p. 264. It is added, with much force and felicity :—"The whole world of nature is laid for such a man under a fantastic law of glamour, and he

becomes capable of believing anything. . . . He is able, with a continually growing neglect of all the facts around him, with equal confidence and equal delusion, *to look back to any past and to look on to any future.*"

93. *Endeavours after the Christian Life*, Vol. I. pp. 281—300.

94. With our own Shakspeare we may compare the most profound sayings that have come down from classic antiquity. . . . "Men are mortal gods, and gods are immortal men." . . . "In the world there is nothing great but Man, and in Man there is nothing great but Mind."

95. Compare the profound legend of *Pan-dora.*

96. Owen, *Vertebrate Skeleton*, p. 197.

97. Bell *On the Hand*, p. 108. "Albinus characterizes the thumb as *manus parva, majori adjutrix.*"

98. Ray in *Bell*, p. 109.

99. *Prometheus Vinctus*, 495, &c.

100. Quinctilian, quoted by *Bell*, p. 218.

101. *Endeavours after the Christian Life*, Vol. I. p. 288.

102. The allusion is to the tale so beautifully told by Campbell.

The deep affections of the breast
That Heaven to living things imparts
Are not exclusively possessed
By human hearts.

A parrot from the Spanish main,
Full young, and early-caged, came o'er
With bright wings to the bleak domain
Of Mulla's shore.

To spicy groves, where he had won
His plumage of resplendent hue,
His native fruits, and skies, and sun,
He bade adieu.

For these he changed the smoke of turf,
A heathery land and misty sky,
And turned on rocks and raging surf
His golden eye.

But fretted in our climate cold
He lived and chattered many a day,
Until with age from green and gold
His wings grew grey.

At last when blind and seeming dumb,
He scolded, laughed, and spoke no more,
A Spanish stranger chanced to come
To Mulla's shore.

He hailed the bird in Spanish speech,
The bird in Spanish speech replied ;
Flapped round the cage with joyous screech,
Dropped down and died.

103. Dr. Brown's *Horæ Subsecivæ :* "Rab and his Friends."

104. Taylor's *Natural History of Society*, Vol. I. p. 40.

105. *Kehama*, Canto X.

106. Childe Harold, Canto IV.

107. Cowper's " Lines on his Mother's Portrait."

108. Longfellow : " Footsteps of Angels."

109. *Iliad* VI. 482—484. *Clytemnæstra*, 883—885.

110. Bell, p. 216.

111. *Essays and Reviews*, p. 139.

112. Auguste Comte, *Positive Philosophy*. I use Miss Martineau's translation, sanctioned by the author, Vol. I. pp. 415—417.

113. *Essays and Reviews*, p. 350.

114. Bishop Horsley writes thus :—

" These notions are indeed perfectly consistent with sound philosophy ; but from them a conclusion has too hastily been drawn that a week would be too short time for physical causes to accomplish their part of the business ; and it has been imagined that a day must be used figuratively to denote at least a thousand years. . . . But the testimony of the sacred historian is *peremptory and explicit*. No expressions could be found in any language to describe a gradual progress of the work for six successive days, in the literal and common sense of the word day, more definite and unequivocal than those employed by Moses ; and they who seek or admit figurative expositions of such expressions as these seem to be not sufficiently aware *that it is one thing to write a history and quite another to compose riddles.* "—Horsley's *Sermons*, XXIII.

So wrote, some half-century ago, the foremost divine of his day. No doubt the reasoning seemed conclusive, and the tone was re-assuring, and the rebuke was palatable to many timid and indignant contemporaries. But unfortunately what seemed helpful to faith fifty years ago has been transferred by the progress of discovery to another service ; and we may imagine the poignant regret it would have cost

Bishop Horsley to have been able to foresee his own success in convincing Mr. Goodwin! Is there nothing here to suggest caution lest the cause of Divine truth be committed to arguments, or implicated in modes of statement, to which the next half-century may lay successful siege? Assuredly none such are needed, so long as all that appertains to its life and essence—if we may use words of which we can understand the force though we transpose the application—"rests on a basis that cannot be shaken, lifting the possessor above the conflicts of erudition, and making it impossible for him to fear the increase of knowledge."—*Phases of Faith*, p. 202.

Additional Note to § 27, § 37, *and Appendix A.*

Perhaps the arguments from Celestial Mechanics and Chemical Proportions admit of a common expression as the *Subjection of Matter to the Mathematics*, that is to Forms of Thought. The movements and combinations of matter *left to itself* must needs have been alike *chaotic*. It is obvious, however, that the evolutions of a highly disciplined steam-squadron on a calm sea, or the dispositions of a consummately trained body of troops on a level field, are vastly less precise manifestations of order and pre-arrangement—in their contrast with the miscellaneous crowd of vessels or of spectators—than the *marshalled* planetary movements or chemical combinations are. Now Number and Figure are Forms of Intellect. Where there is shadow there is substance: where there is Mathematic there is Mind. Whatever is *perusable* by Thought, or speaks to Thought, must have sprung from Thought. That these movements and combinations can be scientifically *apprehended* by the mind of Man, implies that they must have been consciously *projected* from the Mind of Omniscience. So true, in its own sphere, the conception of the Divine Being as "geometrizing;" and so trustworthy the great legacy of the Greek philosophy—whether we apply it to vital architecture or to cosmical phenomena—the doctrine of the Platonic Archetype.

Matter, then, and its primary properties, *per se*, must be distinguished from what we may call *matter mathematicized*. Gravitation, as a *fact*—the tendency of material particles to coalesce and cohere—was known to the ancients* as well as to Sir Isaac Newton: as a

* *E. g.* Ovid: "Tellus . . . pressa gravitate sui."

law, assuming numerical expression, it became, in his hands, for the first time, the revelation of Divine Reason and Rule.

Note to Table I. p. 38.—In this Diagram, the Flora and Fauna columns, when read across, must not be *rigidly* referred to the column of single systems (the space available precluding such reference), but only *generally* to the type-systems or groups.

G. CORNWALL AND SONS, ABERDEEN.