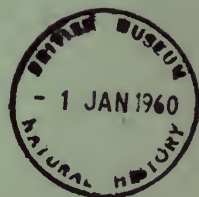


.M.
A.
O.

DARWIN'S NOTEBOOKS ON TRANSMUTATION OF SPECIES

Edited with an Introduction and Notes by
SIR GAVIN DE BEER



BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
HISTORICAL SERIES

Vol. 2 No. 2

LONDON: 1960

DARWIN'S NOTEBOOKS ON
TRANSMUTATION OF SPECIES
PART I. FIRST NOTEBOOK
(JULY 1837—FEBRUARY 1838)

Edited with an Introduction and Notes

BY

SIR GAVIN DE BEER *x-ref.*



Pp. 23—73; 3 Text-figures

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
HISTORICAL SERIES

Vol. 2 No. 2

LONDON: 1960

THE BULLETIN OF THE BRITISH MUSEUM
(NATURAL HISTORY), *instituted in 1949, is
issued in five series, corresponding to the Departments
of the Museum, and an Historical series.*

*Parts will appear at irregular intervals as they become
ready. Volumes will contain about three or four
hundred pages, and will not necessarily be completed
within one calendar year.*

This paper is Vol. 2, No. 2 of the Historical series.

© Trustees of the British Museum, 1960

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued January, 1960

Price One Pound

DARWIN'S NOTEBOOKS ON TRANSMUTATION OF SPECIES

Edited with an Introduction and Notes by

SIR GAVIN DE BEER

PART I. FIRST NOTEBOOK (JULY 1837—FEBRUARY 1838)

INTRODUCTION

IN Darwin's *Journal*¹ the year 1837 contains an entry which runs, "In July opened first notebook on 'Transmutation of Species'—Had been greatly struck from about month of previous March on character of S. American fossils—& species on Galapagos Archipelago. These facts origin (especially latter) of all my views." This notebook is transcribed and printed below and forms the subject of the present study.

The four Notebooks on Transmutation of Species are the first implementation of the suggestion put forward by Darwin in his Ornithological Notebook² referring to his visit to the Galapagos Islands in September and October 1835. There he wrote:—"When I recollect the fact, that from the form of body, shape of scale and general size, the Spaniards can at once pronounce from which Isd. any tortoise may have been brought:—When I see these Islands in sight of each other and possessed of but a scanty stock of animals, tenanted by these birds but slightly different in structure and filling the same place in Nature, I must suspect they are only varieties. The only fact of a similar kind of which I am aware is the constant asserted difference between the Wolf-like Fox of East and West Falkland Islands.—If there is the slightest foundation for these remarks, the Zoology of Archipelagoes will be well worth examining; for such facts would undermine the stability of species".

The First Notebook, begun in July 1837, represents the state of Darwin's opinion as it developed six months after his return to England, the results of his consulting the literature on the subject, and the first formulation of his conviction that the stability of species had been "undermined".

It will be noticed that the passage from the *Journal* quoted above must have been a retrospective entry written at a later date, for if he only began his Notebook in July 1837 he could not then have known what "all his views" were. In this First Notebook itself Darwin stated that he finished it "probably" in February 1838,

¹ "Darwin's Journal", edited by Sir Gavin de Beer, *Bull. Brit. Mus. (Nat. Hist.) Historical Series*, vol. 2, p. 1, 1959.

² *Charles Darwin and the Voyage of the Beagle*, edited by Nora Barlow, London 1945, p. 246. It is not known at what exact date these words were written.

and this was nine months before he read Malthus's *Essay on Population* which, as he said¹ (and Wallace also admitted² in his own case) supplied him with the remaining piece that he required to complete the construction of his argument. What that argument was is known from Darwin's³ *Sketch* of 1842 and *Essay* of 1844, from which the *Origin of Species* was elaborated without much novelty of principle.

The First Notebook is therefore of great importance in tracing the course of his thoughts and the extent of his knowledge before his cognisance of Malthus's work, and will throw light on what it was in the latter which gave Darwin that extra idea which acted as a spark and launched him on his course.

At the outset, however, it must be made clear that the Notebooks all suffer from a grave defect. In the First Notebook Darwin himself wrote on the first page⁴: "All useful pages cut out. December 7, 1856. (and again, looked through April 29, 1873)." In spite of all attempts to trace the missing fifty pages, in the Cambridge University Library where Mr P. J. Gautrey searched for them, at Down House and the Royal College of Surgeons where Miss J. Dobson looked for them, and in the British Museum (Natural History) where Miss M. Skramovsky hunted for them among the letters addressed to Darwin deposited by Mr Robin Darwin, they could not be found. The nature of their contents can only be surmised after a close study of the two hundred and thirty pages that remain, and an estimate can be made of what is missing from the information and the argument.

Another reason why the Notebooks are important is because Darwin has from time to time been reproached for having obtained information from the writings of other men without acknowledging the source. The *Origin of Species*, as is well known, contains the names of Darwin's authorities for the facts stated, but not their bibliographical references, for Darwin regarded his book as only an abstract from the much larger work on which he was then engaged but never finished. The *Sketch* of 1842 and the *Essay* of 1844, likewise, contain names without bibliographical references, but they were written only as an exercise in reviewing the state of his own argument and not intended for publication. The Notebooks, as will be seen, contain names and references.

Before any conclusion can be drawn on Darwin's indebtedness to his predecessors three considerations must be borne in mind. The first is the precise identification of what the original contribution to science was which Darwin himself claimed to have made. This is known from a letter⁵ which he sent on 18th January 1860 to Baden Powell. "No educated person", he wrote, "not even the most ignorant, could suppose that I meant to arrogate to myself the origination of the doctrine that species had not been independently created. The only novelty in my work is the attempt to explain *how* species became modified, & to a certain extent how the

¹ *The Autobiography of Charles Darwin*, edited by Nora Barlow, London 1958, p. 120.

² Alfred Russel Wallace, "Note on the passages of Malthus's 'Principles of Population' which suggested the idea of natural selection to Darwin and myself." *The Darwin and Wallace Celebration held on Thursday, 1 July 1908 by the Linnean Society of London*, London 1908, pp. 111-118; especially p. 117.

³ Darwin's *Sketch* of 1842, and *Essay* of 1844 are reprinted in Charles Darwin and Alfred Russel Wallace: *Evolution by Natural Selection* with a Foreword by Sir Gavin de Beer, Cambridge 1958.

⁴ All page references to Darwin's Notebooks on transmutation of species are to the pagination of the original manuscripts indicated in the margin of the transcription printed below.

⁵ "Some unpublished letters of Charles Darwin", edited by Sir Gavin de Beer, *Notes and Records of the Royal Society of London*, vol. 14, 1959, p. 52.

theory of descent explains certain large classes of facts ; & in these respects I received no assistance from my predecessors."

In arriving at a just appraisal of Darwin's character, this quoted passage is very important, and his contention is correct. Some of his predecessors, as will be seen, acknowledged evolution but had no notion of any mechanism adequate to explain its cause, let alone any idea of natural selection ; two contemporaries¹ recognized natural selection but used it to prove that evolution could not occur. Unknown to Darwin, two other men² had, before him, grasped the solution of the problem and stated that natural selection could cause modification of species ; but they were very far from being able to appreciate the significance of what they had done, provide evidence to support it, or work out its consequences.

The second consideration to bear in mind is that while Darwin was always on the look-out for facts, what he most hoped for in the works of his predecessors and contemporaries was ideas.

The third consideration is the necessity of appreciating what information and opinions, correct and false, were available in 1837 when Darwin "opened" his Notebook. Chief among these was the folk-belief in the inheritance of acquired characters. As Conway Zirkle has shown,³ this is based on an uncritical combination of two propositions each of which by itself is approximately correct. The first is that organisms can be changed, often in an adaptive manner, by the conditions of the environment. The blacksmith's muscles are enlarged as a result of wielding his hammer. The second proposition is that organisms tend to produce offspring like themselves not only in physical features but in functional characters like gait and voice. Hence the conclusion is drawn that parents modified by the environment will produce offspring showing the same modifications.

This syllogism is invalidated because its middle term (resemblance between parent and offspring) is not only undistributed, but, as modern genetics has proved, fallacious. Offspring are not the product of their parents, but of germ-cells of which the parents are only the life-custodians. The old block produces no chip but is the elder brother, and the chip resembles him, if he does, because both are the product of the same line of germ-plasm.

The old wives' tale of the hereditary effect of environmentally evoked modifications or inheritance of acquired characters is deeply built-in to folk lore. It appears in one of the earliest Greek myths. When Phaethon drove his father Apollo's chariot across the sky, the horses got out of control and carried the sun much too near Abyssinia with the result that the Ethiopians' skins were scorched black, and their offspring became the negroes.

In the form of hereditary transmission of maternal impressions, it also appears in the Old Testament.⁴ Jacob when working for Laban agreed that he could not have any white sheep or unspotted goats, but if any lambs were born brown or any goats spotted and speckled, he might have them for himself. Jacob thereupon

¹ Charles Lyell and Edward Blyth.

² William Charles Wells and Patrick Matthew.

³ Conway Zirkle. "The early history of the idea of the inheritance of acquired characters and of pangenesis", *Trans. Amer. Phil. Soc.*, vol. 35, 1946, p. 91.

⁴ *Genesis*, 30, 30-42.

selected the strongest animals and presented to their eyes striped patterns of green leaves and white rods just before they conceived, with the result that they "brought forth cattle ringstraked, speckled, and spotted" which therefore belonged to Jacob; the weaker, untreated animals produced offspring which remained true to the specification of Laban's property.

In the revival of science in the 18th century, Maupertuis, Diderot, Buffon, Erasmus Darwin, and Lamarck accepted the hereditary transmission of environmentally induced modifications as a matter of course.¹ It would never have occurred to them, or to Darwin, to doubt it. Nor would it have occurred to Darwin that in making use of this notion he was in any way indebted to Lamarck. In all the history of science before 1800 only three names stand out in opposition to the old fallacy: Lucretius, because he believed in particulate inheritance with "atoms" of inheritance derived from previous generations; Charles Bonnet, whose theory of *emboitement* of all future generations within the parent involved predetermination which could not admit of modification; and Immanuel Kant, who repudiated it because otherwise evolution would have occurred, and he believed that it had not.

As Loren Eiseley² has remarked, it only remains to underline the irony with which this fallacy has been identified with the name of Lamarck who did not invent it. The term "Lamarckism" should in all justice be applied to evolution itself, since he was the first to advocate it as a co-ordinated system.

Belief in the inheritance of acquired characters was a consequence of the total ignorance of the nature of hereditary transmission. For incontrovertible experimental knowledge of this process, science had to wait not only for Gregor Mendel to publish his results in 1866, but for scientists to rediscover them in 1900; for T. H. Morgan and his colleagues to extend them and correlate them with the results of research in chromosome cytology, developed to a marvellous degree by C. Stern and C. D. Darlington; and for Sir Ronald Fisher³ to produce his great synthesis in 1930, wherein he demonstrated that the mechanism of particulate inheritance of Mendelian genes which remain uncontaminated, segregate, recombine, self-copy, and occasionally mutate, provides exactly what Darwinian selection theory requires to explain the source of variation; that Selection provides exactly what Mendelian theory requires to explain why some genes become dominant, others recessive, and others again suppressed; and that no mechanism other than selection will explain all the facts.⁴

In Darwin's day there was nothing to go on at all except the age-old belief that like tends to beget like, and that when parents differed their offspring represented an average between them. This view is referred to as "blending inheritance", and it permeates Darwin's work and caused him the greatest trouble since it supposed that variance was halved at each generation and obliterated in ten generations, which therefore made it so difficult to account for the necessary supply of variation.

It is not easy today to realize the difficulty presented in Darwin's time by the

¹ Jean Rostand. *L'évolution des espèces*, Paris 1932, and *L'atomisme en biologie*, Paris 1956.

² Loren Eiseley. *Darwin's Century*, London 1959, p. 204.

³ R. A. Fisher. *The Genetical Theory of Selection*, Oxford 1930.

⁴ R. A. Fisher. "The bearing of genetics on the theory of evolution", *Science Progress*, vol. 27, 1932, p. 15.

extinction of species. To admit that species of plants or animals could become extinct involved the admission that the protection of divine providence had been withheld from such species, and a considerable part of Darwin's early work was devoted to this problem, which was really a necessary corollary to the view that species were mutable. If in accordance with the hypothesis of mutability species split and gave rise to other species, the problem of the disposal of old obsolete species necessarily arose, and its solution by accepting the fact of extinction was not only an inevitable conclusion, but a help to Darwin in explaining why the gaps between some species were larger than those between others.

There was another fallacy which obstructed the progress of biological science, especially in Great Britain during the twenties and thirties of the nineteenth century, namely the quinarian theory¹ associated with the name of William Sharp MacLeay. This was the mystical system of classification built on the supposition that at all levels the animal kingdom is based on five groups arranged in a circle, each with affinities to its neighbours on both sides, each containing five sub-groups arranged in a comparable manner with affinities to their neighbours, and so on. According to MacLeay, "There are five great circular groups in the animal kingdom which possess each a peculiar structure," and "these, when connected by means of five smaller osculant groups, compose the whole province of zoology."² In the Crustacean circle, itself one of the five groups of the Annulosa, the Decapoda "have relations of analogy" with the Araneidea of the Arachnid circle while the latter's Acaridea have "relations of analogy" with the Diptera of the neighbouring insect circle.

Presently, Edward Newman improved on MacLeay's quinarian system by substituting the number 7 for 5 because of the 7th day of Creation, etc. "Most groups of animals with which we are tolerably well acquainted are divisible into seven; we shall never find the number greater, and when less, we shall invariably perceive that the deficiency exists in groups of which our knowledge is particularly limited."³

There would be no need to make mention of such abject nonsense were it not for the fact that at the time when Darwin opened his Notebook these notions were current, and, as will be seen, (pp. 46, 129), Darwin himself had to struggle through them when considering the problem of affinities between different groups.

Next, it will be profitable to consider the legacies of Darwin's immediate predecessors and the contributions of his contemporaries that were known to him. First comes Erasmus Darwin.⁴

Erasmus Darwin believed in the transmutation of species and evolution because of the observed changes undergone by organisms during their life-history, the changes brought about by domestication and resulting from hybridization, and monstrous

¹ William Sharp MacLeay. *Horae entomologicae*, London 1819-21. The Quinarian System was also adopted by William Swainson: *The natural history and classification of birds*, *Lardner's Cabinet Cyclopaedia*, London 1837, vol. 2, pp. 56 and 100.

² MacLeay. *op. cit.* p. 318.

³ Edward Newman. *Sphinx vespiiformis: an essay*, London 1832, p. 15. Since nature possesses the tendency for the formation of globes or circles (e.g. the sun and its planets), he agrees with the principle of MacLeay's quinarian system, but substitutes the number 7 for 5, because God rested on the 7th day, Noah took 7 clean animals into the ark, there were 7 plagues, 7 years of famine, 7 years of plenty, 7 golden candlesticks, 7 churches, 7 angels, 7 spirits of God.

⁴ Erasmus Darwin. *Zoonomia; or, the laws of organic life*, vol. 1, London 1794.

births. He was aware of the general similarity of structure shown by vertebrate animals, and he believed that the modification of species was brought about by the satisfaction of wants for "lust, hunger, and danger",¹ and as a result of "their own exertions in consequence of their desires and aversions, of their pleasures and pains, or of irritations, or of associations; and many of those acquired forms or propensities are transmitted to their posterity."² He therefore accepted the inheritance of acquired characters.

In his work, an astonishing number of principles can be found which echo later developments in Darwin's hands. Adaptation, protective colouration, the struggle for existence, artificial selection, sexual selection, vestigial organs, the importance of cross-fertilization, the significance of monsters as proof against preformation in primordial germs, and the occurrence of mutations such as polydactylous cats and rumpless fowls, are all touched on. But when Erasmus Darwin ascribed the production of adaptation to "the power of acquiring new parts, attended with new propensities, directed by irritations, sensations, volitions, and associations; and thus possessing the faculties of continuing to improve by its own inherent activity, and of delivering down those improvements to its posterity, world without end",³ a "power working from within", and "internal impulse", or a "living force," it is easy to see why such a hard-headed scientist as Darwin should have been "much disappointed, the proportion of speculation being so large to the facts given" in the work of his grandfather.

One observation Darwin did cull from Erasmus Darwin's *Zoonomia*, as the First Notebook shows (p. 1), namely that sexual reproduction is conducive to variation, whereas asexual reproduction allows of none.⁴ This fact, which has no direct bearing on Erasmus Darwin's views on evolution, became the basis of Darwin's views on the supply of variation.

Lamarck⁵ believed in the mutability of species because of the difficulty of distinguishing between species and varieties,⁶ and having with a stroke of genius substituted for the old static scale of beings a dynamic branching tree,⁷ his was the first scientific formulation of the "transformism" of species, although he only assumed it as axiomatic and provided no evidence to support it. He was familiar with the fact of the struggle for existence⁸ and the importance of adaptation; he realized the vast amount of time required for evolution to have taken place, but appeared to think that species had not suffered extinction but had instead become transformed.⁹

Before proceeding to consider Lamarck's attempt to provide an explanation of

¹ Erasmus Darwin. *op. cit.* p. 503.

² Erasmus Darwin. *op. cit.* p. 503.

³ Erasmus Darwin. *op. cit.* p. 505, cf. also p. 500: "in the more advanced state of the fetus, it evidently possesses volition; as it frequently changes its attitude, though it seems to sleep the greatest part of its time; and afterwards the power of volition contributes to change or alter many parts of the body during its growth to manhood, by our early modes of exertion in the various departments of life."

⁴ Erasmus Darwin. *op. cit.* p. 487.

⁵ Jean Baptiste de Lamarck. *Philosophie Zoologique*, Paris 1809.

⁶ Lamarck. *op. cit.* vol. 1, p. 73.

⁷ Lamarck. *op. cit.* vol. 1, p. 76: "une série rameuse."

⁸ Lamarck. *op. cit.* vol. 1, p. 112.

⁹ Lamarck. *op. cit.* vol. 1, p. 93.

the cause of "transformism"¹ or "evolution" as Lyell² termed it, there is a matter which calls for attention in the reasoning behind Lamarck's argument by which he reached the conclusion that transformism had occurred. It was based on the notion that the greater the number of species of a genus that were collected and studied, the more they appeared to grade insensibly into one another, with the result that taxonomic distinctions could not be made between them. If this were really so, systematic classification would be logically impossible. Using the expression of "species-barrier", so happily coined by Professor Loren Eiseley,³ it could be said that Lamarck did not discover the solution to the problem of how to penetrate it, but that he abolished it. As Sir Ronald Fisher has pointed out,⁴ this criticism must not be applied to the solution found by Darwin of how the species-barrier could be penetrated, because Darwin was careful to recognize that species are well-defined even if their limiting characters are changeable.

Lamarck's explanation of the cause of transformism is contained in his four laws⁵:—
 1. Life, by its own forces, tends continually to increase the volume of every body possessing it and to extend the dimensions of its parts, up to the limits which it sets itself. 2. The production of a new organ in an animal body results from the emergence of a new need which continues to make itself felt, and a new movement which this need evokes and maintains. 3. The development of organs and their power of action stand in constant relation to their use. 4. Everything that has been acquired, traced, or changed in the organization of individuals in the course of their life is preserved by generation and transmitted to the new individuals that descend from those which have experienced those changes.

The tendency to perfection⁶ resulting from Lamarck's first Law necessitated an explanation of the persistence on earth of forms like infusoria which remain "imperfect", and this he provided by supposing that spontaneous generation⁷ had taken place continuously, and that the more "imperfect" an organism is, the more recently its stock was generated.

The "movements" from which the production of new organs is supposed to follow,

¹ The term "transformism" is preferred by many French-speaking authors (e.g. Alphonse de Candolle, *Darwin*, 2nd edition, Genève 1882, p. 35) because the successive changes are not always in the direction of increased development but may result in simplification. cf. also Jean Rostand. *L'état présent du transformisme*, Paris 1931, p. 13.

² Charles Lyell. *Principles of Geology*, London 1832. vol. 2, p. 11 which contains the first use in English of the term evolution in its present accepted sense.

³ Eiseley. "Charles Darwin, Edward Blyth, and the theory of natural selection." *Proc. Amer. Phil. Soc.* vol. 103, 1959, p. 108.

⁴ Sir Ronald Fisher. "Retrospect of the criticisms of the theory of natural selection", *Evolution as a Process* edited by Julian Huxley, A. C. Hardy and E. B. Ford, London 1954, p. 88.

⁵ Lamarck. *Histoire naturelle des animaux sans vertèbres*, Paris 1815, vol. 1, p. 181: "1^{ère} loi. La vie, par ses propres forces, tend continuellement à accroître le volume de tout corps qui la possède, et à étendre les dimensions de ses parties, jusqu'à un terme qu'elle amène elle-même.

"2^{ème} loi. La production d'un nouvel organe dans un corps animal, résulte d'un nouveau besoin survenu qui continue de se faire sentir, et d'un nouveau mouvement que ce besoin fait naître et entretient.

"3^{ème} loi. Le développement des organes et leur force d'action sont constamment en raison de l'emploi de ces organes.

"4^{ème} loi. Tout ce qui a été acquis, tracé ou changé, dans l'organisation des individus, pendant le cours de leur vie, est conservé par la génération, et transmis aux nouveaux individus qui proviennent de ceux qui ont éprouvé ces changements."

⁶ Lamarck. *Philosophie Zoologique*, vol. 1, p. 263.

⁷ Lamarck. *Philosophie Zoologique*, vol. 1, p. 82; vol. 2, p. 78.

Lamarck contended are due to the *sentiment intérieur*,¹ or inner feeling possessed by "those animals which have a nervous system sufficiently developed to permit them to experience sensation. This feeling, although obscure, is very powerful for it is the source of the internal emotions experienced by those individuals that possess it, and therefore is the source of that curious force which places those individuals in a position to produce themselves the movements and actions which their needs demand". Lamarck's attempts to define his *sentiment intérieur* were not felicitous. In one place he wrote² of "the emotions of the inner feeling which actuate animals and man himself, sometimes without any participation of the will, sometimes by an act of volition that gives rise to it." Elsewhere,³ the inner feeling is made responsible for the good time with which a deaf and dumb girl was able to play the piano, "the whole of her person was actuated by measured movements of her inner feeling".

It has been held that Lamarck's reputation has suffered from faulty translation of his works; but to those who are competent to dispense with translation his works are not more acceptable, because his conclusions are contrary to the results of observation and experiment. When it is contended, as it has been, that the essence of Lamarckism is that when structures become necessary they appear, the matter ceases to belong to the realms of science. Animals strive for food, mates, and protection, and they scour for habitats and select them as Charles Elton⁴ has stressed, which increases the possibilities of adaptation by multiplying the occasions for trial and error and exposing organisms of different genetic composition to different environments; but this characteristic behaviour of mobile animals is not explained by ascribing an "inner feeling" to them; nor is this an acceptable substitute for natural selection, mutation, and recombination of genes to account for evolution.

The similarity between Erasmus Darwin's "volition" and Lamarck's "inner feeling" as agents made responsible for evolution is remarkable, but there is no reason to suppose that the latter owed anything to the former; still less to imagine that Darwin was not speaking the truth when he said of Lamarck's work that he "got not a fact or idea from it".

Charles Lyell's work, without any doubt, exerted the most important influence on Darwin's thought. Curiously enough, this was not because of any facts which enabled Darwin to construct his theories of coral reefs or of evolution by natural selection; on the contrary, in these subjects Darwin contradicted most of what Lyell had thought or written. It was the background of uniformitarianism in Lyell's *Principles of Geology* which provided Darwin with the general orientation of thought and method which enabled him to succeed where others, including Lyell himself,

¹ Lamarck. *Philosophie Zoologique*, vol. 2 p. 256: le "*sentiment intérieur*, n'est point commun à tous les corps vivants, et ... ne l'est pas même à tous les animaux, ... est un sentiment ... dont sont doués les animaux qui ont un système nerveux assez développé pour leur donner la faculté de sentir."

² Lamarck. *op. cit.* vol 2, p. 259: Les "émotions du sentiment intérieur, qui font agir les animaux et l'homme même, tantôt sans aucune participation de leur volonté, et tantôt par une volonté qui y donne lieu ... sentiment intérieur ... susceptible de s'émouvoir par des causes qui l'affectent; or, ces causes sont toujours le besoin, soit d'assouvir la faim, soit de fuir les dangers, d'éviter la douleur, de rechercher le plaisir, ou ce qui est agréable à l'individu."

³ Lamarck. *op. cit.* vol. 2, p. 262: "toute sa personne était mue par des mouvements mesurés de son sentiment intérieur."

⁴ Charles Elton. *Animal Ecology and Evolution*, Oxford 1930, p. 51.

had failed to build and establish a coherent and scientifically satisfactory basis for biology.

As Professor Loren Eiseley¹ has so convincingly shown, it is an astonishing irony of history of science that Lyell did not discover Darwin's solution to the problem, for Lyell possessed all the ingredients which Darwin required to construct his theory. Already in 1832, the year in which the second volume of his *Principles of Geology* appeared, Lyell was familiar with the struggle for existence, ecological balance, the extinction of species, and even with the principle of natural selection by which extinction was brought about:² "A faint image of the certain doom of a species less fitted to struggle with some new condition in a region which it previously inhabited, and where it has to contend with a more vigorous species, is presented by the extirpation of savage tribes of man by the advancing colony of some civilized nation." But as Lyell in these early years refused to accept evolution, natural selection had no part to play in bringing it about in his scheme. Lyell recognized the succession of species and was well acquainted with the facts of geographical and geological distribution. The only thing which he rejected, as just stated, was evolution itself, and the curious reason for this has been admirably brought to light by Professor Eiseley.

Cuvier had broken the old notion of the scale of beings as a figurative single beanstalk, and had substituted for it a succession of stages of life, each terminated by a catastrophe. "Catastrophism" required that life started again after each revolution; but as it was obvious that the forms of life showed progress in organization after each catastrophe, it was necessary to invoke a principle of "progressionism" on the part of the creative power. Imbued with the superior scientific value of uniformitarianism over catastrophism, Lyell repudiated the latter and, therefore, progressionism with it. The baby of evolution was thrown out with the bathwater of pseudo-geological magic, and Lyell missed one of the finest opportunities in the history of science. This was perhaps the greatest debt that Darwin owed to him.

The First Notebook contains a number of references to the names and works of other men, some of which may have been the start of ideas which subsequently played parts of great importance in the construction of Darwin's system. Among these is Cuvier whose views on the immutability of species Darwin of course challenged (pp. 53, 88, 89). But there is also a reference (p. 118) to some remarks by Cuvier's brother Frédéric on the production of domestic races of animals, in the course of which he wrote: "we could only produce domestic individuals and not races, without the concurrence of one of the most general laws of life, the transmission of the organic or intellectual modifications by generation. Here one of the most astonishing phenomena of nature manifests itself to us, the transmission of a *fortuitous* [our italics] modification into a durable form, of a fugitive want into a fundamental propensity, of an accidental habit into an instinct."

Professor Eiseley³ has drawn attention to the extremely important question of what led Darwin to believe in the chance emergence of new characters. It is the

¹ Eiseley. *Darwin's century*, p. 102.

² Charles Lyell. *Principles of Geology*, vol. 2, London 1832, p. 175.

³ Eiseley. *op. cit.* p. 202.

fundamental difference between the Darwinian view of fortuitous variation (which has been experimentally demonstrated by Sir Ronald Fisher as correct), and all other attempts to explain evolution as due to adaptively directed mutation. It is at the base of the argument about design. If variation were designed, as Darwin wrote¹ to Asa Gray, 26th November 1860, "you would have to believe that the tail of the Fantail was led to vary in the number and direction of its feathers in order to gratify the caprice of a few men"; and again² on 5th June 1861: "It is not that designed variation makes, as it seems to me, my deity 'Natural Selection' superfluous, but rather from studying, lately, domestic variation, and seeing what an enormous field of undesigned variability there is ready for natural selection to appropriate for any purpose useful to each creature." In the last pages of his book³ *Variation of animals and plants under domestication*, Darwin drew up a fearsome list of consequences for those who believe in designed rather than in fortuitous variation, for they would be obliged to accept design as responsible for hosts of variations that are most injurious to the organisms concerned. Today, with modern knowledge of the properties of lethal genes, such arguments appear elementary, but in Darwin's day they were very topical, and it is at least probable that Frédéric Cuvier's remarks on "fortuitous modifications" started Darwin on this fundamentally important train of thought.

In the light of recent research on mutation of genes, the term "fortuitous" variation is preferable to the older term "random" variation, because although no correlation has ever been found between a mutagenic agent and the quality of adaptiveness in the character controlled by the resulting mutant gene, it is clear that chemical properties of mutagenic agents may induce some rather than other mutations. To this extent therefore mutations are fortuitous rather than random, since randomness implies equality of possibilities of mutation in any direction; but equally there can be no question of biologically significant directedness in the mutations.

The geologist Leopold von Buch is not a source from which it is generally known that Darwin derived information or ideas for his special purposes, and yet in the Notebook of 1837 he is quoted twice for facts which were of supreme importance to Darwin. In the first (p. 156), von Buch related that on the island of Tristan d'Acunha, Du Petit Thouars found only 25 species of flowering plants of which some resembled the flora of the Cape and others that of South America. This played an important part in shaping Darwin's views on the colonization of islands and in framing the rhetorical question whether these species were created like this in order to deceive man (p. 218).

The second reference (p. 158) is even more important, for in it von Buch stated two fundamental propositions quite clearly:— that permanent varieties give rise to distinct species, and that geographical isolation of a region in which such a variety arises is the chief factor in its conversion into a new species by preventing intercrossing with the remainder of the parent population.

¹ *Life and Letters of Charles Darwin*, edited by Francis Darwin, vol. 2, 1887, p. 353.

² *Ibid.* vol. 2, p. 373.

³ London 1868, vol. 2, p. 431.

That Darwin was indebted to Humboldt in a general way was known already from the *Autobiography*, but the Notebook shows (p. 142) that Humboldt's *Personal Narrative* contains a remark which reinforces that of von Buch: "The exclusion of all foreign mixture contributes to perpetuate varieties, or the aberrations from a common standard."

The part which isolation can play in the formation of species is mentioned in the *Origin of Species* (World's Classics p. 105), but in later life Darwin believed that it was not essential: a view contested by Moritz Wagner and Ernst Mayr.¹

To Etienne Geoffroy-Saint-Hilaire it is possible that Darwin owed the germ of an idea of the relation between final and mediate causes. His name appears in the Notebook (p. 114) in connexion with the notion of the creator giving laws and leaving things to follow their consequences. This idea reappears in the *Sketch* of 1842 (p. 86), the *Essay* of 1844 (p. 254), and the *Origin of Species* (World Classics edition p. 559).

Mention must be made of the Hon. and Rev. William Herbert, the heterodox plant-breeder whose name figures in the Notebook (pp. 180, 191). He supplied Darwin with the information that in some genera the barrier of sterility between the species did not exist, and that there was no real difference between species and varieties.

Another man to whom Darwin was certainly indebted was William Paley, whose works on Natural Theology provided him with a catalogue of cases of adaptation and an argument which he used in reverse to show the efficacy of natural selection without design. His name does not appear in the extant portion of the Notebook, nor is there any reason why it should because neither adaptation nor the problem of design figure in it.

There was also John Stevens Henslow (mentioned on pp. 68 and 230), a devout believer in the fixity of species, to whom Darwin owed no particular information at all, but a great and loyal friendship, encouragement in his pursuits of natural history, the opportunity of embarking on the *Beagle*, and the suggestion that he should take with him (but not agree with) Lyell's *Principles of Geology*.

Edward Blyth was a man with whose works, as Professor Eiseley² has shown, Darwin who was his friend must have been familiar, but whose name and works do not appear in the extant portion of the First Notebook although they do in the Second. In a series of papers published between 1835 and 1837, Blyth touched on a number of subjects with which Darwin was concerned, including a remarkable description of the results of variation in species preyed upon by predators such as birds of prey. If the behaviour or colour of the variants departs from the typical specific character, either by failing in vigilance or in assuming a protective attitude or in matching its normal background, or in straying away from its normal background, such variants fall victim to the predator by the natural interplay of causes which remove "all that deviate from their normal or healthy condition, or which occur away from their proper and suitable locality", and thereby "tend to limit the

¹ Ernst Mayr. "Isolation as an evolutionary factor", *Proc. Amer. Phil. Soc.*, vol. 103, 1959, p. 221.

² Eiseley. "Charles Darwin, Edward Blyth and the Theory of Natural Selection", *Proc. Amer. Phil. Soc.*, vol. 103, 1959, p. 94.

geographical range of species, and to maintain their pristine characters without blemish or decay to their remotest posterity." In other words, like Lyell before him (see above), Blyth who believed in special creation used the principle of natural selection to prove that species were immutable.

Bearing in mind that Darwin was after only one thing : how species became modified, it may be asked what Darwin's debt to Blyth was. So far as the construction of his theory is concerned, the answer is probably nothing at all. But Professor Eiseley also raises the question whether there were not items of information in Blyth's papers which Darwin built into his own body of knowledge, and bases it on the appearance in Darwin's notebooks and *Sketch* of expressions and statements which are also found in Blyth's papers. One such item is the word "osculant";¹ others are mentions of Ancon sheep and of mutations such as polydactylous cats or rumpless fowls. Blyth's paper of 1835 and Darwin's First Notebook both contain mention of what Blyth called "the fact, equally well-known, of bullfinches . . . becoming wholly black when fed entirely on hempseed." Additional similar correspondences can probably be found, and although Darwin may have obtained some of them from other sources such as Lyell and Erasmus Darwin, and certainly found the expression "osculant" in the work of MacLeay, there is nothing improbable in his having copied some from Blyth. Indeed, Darwin's references to Blyth in the *Origin of Species*, *Variation in Animals and Plants under Domestication*, and the *Descent of Man*, are very numerous and generous on subjects other than how species become modified.

It forms no part of the intention of this study to defend Darwin from the imputation that he made unacknowledged use of Blyth's or any one else's work as regards the mechanism of natural selection. Darwin (and others) may have been wrong in thinking that he owed him or them nothing on this score.

Robert Edmund Grant surprised² Darwin as early as 1826 by speaking in high admiration of the work of Lamarck, and the anonymous paper³ published in the *Edinburgh New Philosophical Journal* in that year when Darwin was in Edinburgh, was probably written by Grant. To this paper Darwin would not have felt himself any more indebted than to Lamarck's book, because it provided no facts that he

¹ Darwin used the word "inosculating" in his letter to Henslow dated 24 November 1832 (*Extracts from Letters addressed to Professor Henslow*, p.p. Cambridge 1835, p. 8). The source of the word is William Sharp MacLeay : *Horae entomologicae*, London 1819-21, p. 396 : "By an external order is meant one situated in the greater segment of a circle of affinity, when divided by a line joining its osculant points. There are ten such, viz. Orthoptera, Neuroptera, Homoptera, Hemiptera, Phalangidea, Scorpionidea? Amphipoda? Laemodipoda? Chilopoda and Thysanura. We may name the five orders, Vermes, Hymenoptera, Diptera, Acaridea, and Branchiopoda, internal, and the ten remaining inosculant, from their communicating with osculant groups." p. 37 "the nature of the genera that form the links of connexion. These genera I propose to call *osculantia*, from their occurring as it were at the point where the circles touch one another . . ." Murray NED : *Osculant* : — intermediate ; two groups united by some common characters and to an intermediate group which unites in itself the characters of two groups. MacLeay 1819, Kirby & Spence 1826 : *Entom.* 4, 382 : "They may form an osculant group, partly winged and partly apterous . . ."

Inosculate, to pass into ; to join ; to blend Kirby & Spence 1816 : *Entom.* 1, 332 : "hooks like those in the laminae of a feather inosculate into one another." Kirby. *Habits and Instincts of Animals*, II, 17, 168 : "The thigh inosculates with" the innominate.

² *Autobiography of Charles Darwin*, edited by Nora Barlow London 1958, p. 49.

³ "Observations on the nature and importance of Geology", *Edinburgh New Philosophical Journal*, vol. 1, 1826, p. 293.

could use, and the late Dr P. Helveg Jespersen has pointed out¹ that Grant shocked Darwin at the time by displaying scientific jealousy when he told Darwin that it was very unfair of him to work on the eggs of *Flustra*, material on which Grant was then engaged.

There are other cases in which Darwin simply forgot to mention his informants. The most striking case of this was his omission of the name of Wallace from the summary in the first edition of the *Origin of Species*.² In 1859 when writing³ to Lyell about the succession of forms, Darwin forgot that he had himself published a paper on this subject in 1837. In 1860 when writing⁴ to Baden Powell he excused himself for not having given a list of his predecessors who rejected special creation, saying that he had attempted no history of the subject; yet later on the same day he remembered that he had a year or two previously drafted a Historical Sketch for his large work on evolution, in which Powell's name was mentioned with honour. All subsequent editions of the *Origin* contained the Historical Sketch. In 1880 when writing⁵ to Samuel Butler about his introduction to Dr Krause's book on Erasmus Darwin, Darwin forgot that he had struck out a passage in proof which unintentionally altered the meaning of a footnote.

The only reason for mentioning these details is that they show, as Professor Eiseley has pointed out, that Darwin for all his eminence and genius was not different from other men; and his Notebooks are like that of any other beginner casting around for facts with which to spin a hypothesis and by which to refute or establish it.

SUMMARY OF DARWIN'S CONCLUSIONS IN THE FIRST NOTEBOOK ON TRANSMUTATION

In order to provide a succinct account of the conclusions to which Darwin had arrived by February 1838, the following summary has been drawn up, leaving out all reference to subjects and questions on which he wanted further information or had not yet made up his mind. The page references are to the manuscript of the First Notebook.

"Definition of Species: one that remains at large with constant character . . . Species may be good ones and differ scarcely in any external character . . . Between species from moderately distant countries there is no test but generation whether good species" (pp. 212, 213).

Variation is observed between the progeny of parents reproducing by sexual methods. No variation is observed among the progeny of stocks reproducing by asexual methods such as budding, fission, or grafts. Therefore "generation", which means sexual reproduction, is a mechanism whereby variation can be produced (p. 3).

Fully-developed organisms have difficulty in varying, but sexual reproduction

¹ P. H. Jespersen. "Charles Darwin and Dr. Grant", *Lychnos* 1948-49, vol. 11, p. 159.

² *Life and Letters of Charles Darwin*, vol. 2, p. 264.

³ *More Letters of Charles Darwin*, edited by Francis Darwin and A. C. Seward, London 1903, vol. 1, p. 133, to which attention was called by Eiseley: *Darwin's Century*, p. 163.

⁴ "Some unpublished letters of Charles Darwin", edited by Sir Gavin de Beer, *Notes and Records of the Royal Society of London*, vol. 14, 1959, p. 52.

⁵ *Autobiography of Charles Darwin*, edited by Nora Barlow, London 1958, p. 182.

provides the means whereby new organisms can vary and become adapted to changed conditions, and conditions on earth have undoubtedly changed (p. 4).

With this tendency of organisms to produce varying offspring by sexual reproduction, why do species remain constant? Because interbreeding between variants in opposite directions quashes variation; and if a pair of breeding organisms be isolated it is very doubtful if their offspring will remain constant (pp. 5, 6). Therefore the offspring of animals on separate islands should become different if they are kept isolated long enough (pp. 5, 6, 7). "As we thus believe species vary, in changing climate we ought to find representative species". We do: e.g. Galapagos tortoises; Falkland Islands fox; English and Irish hare (p. 8). If new species result from isolation, their subsequent spread will be along rays from a centre (p. 155).

In islands near continents, recent arrivals would be similar to the organisms on the mainland; earlier arrivals might have varied provided that the original types had not continued to arrive. Examples: Galapagos Islands; Juan Fernandez (pp. 10, 11).

"Propagation" of species which means the origin of new species from other species, by descent, not by special creation, explains why on a continent there may be living species of the same type as extinct forms. Examples: Edentates in South America. "Parent of all armadillos might be brother of Megatherium, uncle now dead". (pp. 14, 54).

Origination of species by descent from a common ancestor explains why in particular continents animals may have the same type of structure although the "necessity" for such structure may not be apparent; but it might have been "necessary" for their common ancestor, in which case "the result would be as it is". Examples: marsupials in Australia; antelopes in South Africa (pp. 12, 14).

In the course of time, all animals may change, and the longer the time since regions were separated, the greater the difference between their animals (pp. 15, 16).

The cause of variation is unknown, except that change is not the result of volition of animals but of adaptation (pp. 17, 21).

If the number of species in an isolated region remains "equable", and variation and multiplication have occurred, some species must have become extinct; and extinction of species is no more extraordinary than death of individuals (pp. 21, 22, 36).

If a variety (e.g. Petise ostrich) is not well adapted for its environment, it will probably perish. If a variety is well adapted (e.g. Orpheus) it will multiply. Extinction is therefore a consequence of non-adaptation (p. 38).

Organisms represent an irregularly branched tree. Some branches are more branched than others, and these are the genera; some twigs die and these are extinct species; new twigs are formed and these are newly originated species (p. 21).

Why do some genera contain aberrant species? "Is it an index of the point whence two favourable points of organization commenced branching?" (p. 28).

If a population remains constant in numbers, say 2000, then 400 years ago perhaps 150 people were the progenitors of the 2000 alive today. This means that there was a selection of ancestors with long progeniture.

Unless the population increases greatly, it is very unlikely that any one man of

a family of 12 will have offspring living 10,000 years hence. If this is true, the larger the group of organisms, the greater will be the gaps between them and the wider their divergence (pp. 40, 42, 146).

In Marsupials the splitting into orders analogous to carnivores, rodents, etc. can be seen just beginning (p. 141).

There is no justification for denying that mammals and fish may have a common ancestor when such strange intermediate forms as the platypus exist (p. 97).

"I cannot for a moment doubt but what Cetacea and Phocæa now replace Saurians of Secondary epoch". This is the principle of the occupation of ecological niches (p. 206).

"My theory will make me deny the creation of any new quadrupeds since days of Didelphys in Stonesfield." (p. 219).

If species are specially created, were South American and African species created on Tristan d'Acunha merely because it lies between Africa and South America, or to deceive man, like fossils in old formations? What was the creative power that was to create species on the Galapagos islands doing before those islands emerged above the sea? (pp. 98, 194, 218).

"Absolute knowledge that species die and others replace them. Two hypotheses : fresh creations is mere assumption ; points gained if any facts are connected." (p. 104).

"The Grand question which every naturalist ought to have before him when dissecting a whale, or classifying a mite, a grampus or an insect is What are the Laws of Life?" (p. 229).

SUBJECTS TREATED IN THE FIRST NOTEBOOK

The chief subjects included in the extant portion of the Notebook are :— reproduction, variation, constancy of variation, causes of variation, heredity, prepotency in crosses, hybridization, breeding-barriers, isolation, geographical distribution, centres of origin of species, conditions of life, radiation, ecological niches, means of transport, taxonomy, instincts, morphology, parasitology, palæontology, geology, extinction, divergence.

Only the briefest references are made to the struggle for existence, selection, and adaptation.

The chief subjects missing are artificial selection, domestic breeds, conditions of domestication, inadequacy of climatic or other environmental conditions to account for resemblance and differences between floras and faunas, principle of gradations, sterility, imperfection of the geological record, affinities and classification, embryonic resemblance, vestigial organs, inheritance of effects of use and disuse.

How far these may have been included in the missing pages is hard to determine. The chief impression left after comparing the First Notebook with the *Sketch* of 1842 is that the latter is imbued with a dynamic background of necessitation which the extant portion of the former lacks. It is here that the effect of reading Malthus's work in October 1838 may most probably be discerned. The principle of selection of better adapted variants is present in the First Notebook (p. 38), but it is presented statically without indication of its universal compelling force.

Why this should be so, in spite of the fact that the struggle for existence was well known to Darwin from the works of Erasmus Darwin, Lamarck, and Lyell, was probably because Malthus was the first to state the problem quantitatively, stressing the discrepancy between the arithmetical rate of increase of food supplies and the geometrical rate of potential increase of organisms. It is in this light that the words should be read which Darwin wrote¹ in 1876: "In October 1838, that is, fifteen months after I had begun my systematic inquiry, I happened to read for amusement "Malthus on Population", and being well prepared to appreciate the struggle for existence which every where goes on from long-continued observation of the habits of animals and plants, it at once struck me that under these circumstances variations would tend to be preserved, and unfavourable ones to be destroyed. The result of this would be the formation of new species. Here then I had at last got a theory by which to work". The clock had been provided with a mainspring.

There is another point on which the First Notebook throws light, for it contains a splendid discussion of the principle of branching and sub-branching of the evolutionary tree (pp. 21, 22), and this shows that Darwin had already grasped fully the principle of divergence. This emerges also from his query whether Geoffroy-Saint-Hilaire visualized evolution as having taken place in straight or in branching lines (p. 113). The question naturally arises how this is to be reconciled with Darwin's statement² written in 1876 referring to the *Essay* of 1844: "But at that time I overlooked one problem of great importance. . . . This problem is the tendency in organic beings descended from the same stock to diverge in character as they become modified".

In trying to explain this discrepancy, Sir Francis Darwin³ was mistaken in thinking that descent with modification necessarily implies divergence; evolution might take place along single lines without any divergence at all. The explanation emerges from a close attention to the *Origin of Species* [6th ed. World's Classics p. 112] where the problem is stated more forcibly: "How, then, does the lesser difference between varieties become augmented into the greater difference between species?" The problem is not only that of branching or splitting a species into two but of widening the split.⁴

What Darwin was referring to in 1876 was not the fact of divergence, for this was clearly stated in the First Notebook, but to a causal explanation of how it occurs and increases. This is also clear from the *Origin* [p. 113]:—"The more diversified the descendants from any one species become in structure, constitution and habits, by so much will they be better enabled to seize on many and widely diversified places in the polity of nature."

Darwin's other Notebooks on Transmutation of Species will be transcribed and printed in subsequent Numbers of this Bulletin.

¹ *Autobiography of Charles Darwin*, edited by Nora Barlow London 1958, p. 120.

² *Ibid.* p. 120.

³ *Life and Letters of Charles Darwin*, vol. 2, p. 15.

⁴ The date when Darwin hit on the solution of the problem of divergence ("I can remember the very spot on the road, whilst in my carriage, when to my joy the solution occurred to me," *Autob.* p. 120), may be placed in 1852 because of a letter from Darwin to George Bentham dated 19 June 1863 (*Life & Letters*, iii, p. 26): "I believe it was fifteen years after I began before I saw the meaning and cause of the divergence of the descendants of any one pair." If the "beginning" was in 1837, the solution came in 1852.

CHARLES DARWIN'S FIRST NOTEBOOK ON TRANSMUTATION
OF SPECIES 1837-1838

Inside cover

C. DARWIN

All useful pages cut out.
Dec. 7 /1856/.
(and again looked through
April 21, 1873).¹

This Book was commenced about July 1837; p. 235 was written in January
1 1838, | perhaps ended in beginning of February.

ZOONOMIA

Two kinds of generation: the coeval kind — all individuals absolutely similar; for instance, fruit trees, probably polypi, gemmiparous propagation, bisection of Planariae etc. etc.

The ordinary kind which is a longer process, the new individual passing through several stages (? typical or shortened repetition of what the original molecule has
2 done). — This appears | highest office in organisation (especially in lower animals, where mind and therefore relation to other life has not come into play) — see Zoonomia² arguments, fails in hybrids, where every thing else is perfect; mother apparently only born to breed, — annuals rendered perennial etc. etc. — Yet eunuch, nor cut stallions, nor nurses are longer lived.

Why is life short, why such high object — generation. —

We *know* world subject to cycle of change, temperature and all circumstances,
3 which | influence living beings.

We see the young of living beings become permanently changed or subject to variety, according to circumstance, — seeds of plants sown in rich soil, many kinds are produced, though new individuals produced by buds are constant; hence we see generation here seems a means to vary or adaptation. — Again we know, in course of
4 generation even mind and instinct becomes influenced. | Child of savage not civilized man. — Birds rendered wild generations acquire ideas ditto. V. Zoonomia. —

There may be unknown difficulty with *full grown* individual with fixed organisation thus being modified, — therefore generation to adapt and alter the race to *changing* world. —

On other hand, generation destroys the effect of accidental injuries, which if
5 animals lived for ever would be endless | (that is with our present system of body and universe. — Therefore final cause of life).

With this tendency to vary by generation, why are species all constant over whole country. Beautiful law of inter-marriages partaking of characters of both parents and then infinite in number.

¹ On this first page Darwin wrote a series of figures in running vertical order, and subsequently scored them out; they were: 26, 30, 41, 46, 50, 54, 66, 67, 69, 76, 79, 91, 93, 107 Ireland, 113, 117.

² Erasmus Darwin. *Zoonomia*; or, the laws of organic life, London 1794, vol. 1, p. 487: "This paternal offspring of vegetables, I mean their buds and bulbs, is attended with a very curious circumstance: and that is, that they exactly resemble their parents, as is observable in grafting fruit-trees, and the propagating flower-roots; whereas the seminal offspring of plants, being supplied with nutriment by the mother, is liable to perpetual variation."

- 6 In man it has been | said, there is instinct for opposites to like each other.
 Aegyptian cats and dogs, ibis — same as formerly, but separate a pair and place them on fresh island, it is very doubtful whether they would remain constant ; is it not said that marrying-in *deteriorates* a race, that is alters it from some end which is good for man. — |
- 7 Let a pair be introduced and increase slowly, from many enemies, so as often to intermarry — who will dare say what result.
 According to this view animals on separate islands, ought to become different if kept long enough apart, with slightly differ[ent] circumstances. — Now Galapagos tortoises, mocking birds, Falkland fox, Chiloe fox. — English and Irish Hare. — |
- 8 As we thus believe species vary, in changing climate we ought to find representative species ; this we do in South America closely approaching. — But as they inosculate, we must suppose the change is effected at once, — something like a variety produced
- 9 — every grade in that case [it] seems is not | produced? —
 Species according to Lamarck¹ disappear as collection made perfect. — Truer even than in Lamarck's time. Gray's² remark, best known species (as some common land shells) most difficult to separate. [Difference in] Every character continues to vanish, — bones, instinct etc. etc. etc. |
- 10 Non-fertility of hybridity etc. etc.
 If species (1) may be derived from form (2) etc., — then (remembering Lyell's³ arguments of transportal) island near continents might have some species same
- 11 as nearest land, which were late arrivals, | others old ones (of which none of same kind had in interval arrived) might have grown altered. Hence the type would be of the continent, though species all different. —
 2 cases as Galapagos and Juan Fernandez.
- When continent of Pacific existed, might have been monsoons. When they ceased,
- 12 importation ceased and | changes commenced ; — or intermediate land existed ; — or they may represent some large country long separated. —
- On this idea of propagation of species we can see why a form peculiar to continents,
- 13 — all bred in from one parent. Why Megathera several | species in S. America? why 2 [species] of ostriches in S. America. — This is answer to Decandolle⁴ (his argument applies only to hybridity) : genera being usually peculiar to same country, different genera — different countries. |
- 14 Propagation explains why modern animals — same type as extinct, which is law almost proved. — We can see why structure is common in certain countries when

¹ Jean-Baptiste de Lamarck. *Philosophie Zoologique*, Paris 1809, vol. 1, p. 75 : "à mesure que nos collections s'enrichissent, nous voyons presque tous les vides se remplir et nos lignes de séparation s'effacer . . . plus nous rencontrons de preuves que tout est nuancé, que les différences remarquables s'évanouissent."

² John Edward Gray. Probably personal communication.

³ Charles Lyell. *Principles of Geology*, vol. 2, London 1832, pp. 96-104.

⁴ Augustin-Pyramus de Candolle. *Essai élémentaire de géographie botanique*, Strasbourg 1820, p. 60 : "Les différences constantes des végétaux nés dans diverses régions ne semblent se rapporter ni à l'une ni à l'autre de ces classes [= produites par les élémens extérieurs + formées par l'hybridité] on ne peut les attribuer aux circonstances externes, . . . on ne peut les attribuer à l'hybridité. . . . [Les] espèces sont distribuées sur le globe en partie d'après des lois qu'on peut immédiatement déduire de la combinaison des lois connues de la physiologie et de la physique, en partie d'après les lois qui paroissent tenir à l'origine des choses et qui nous sont inconnues." [This question was discussed by Lyell, *Principles of Geology*, vol. 2, London 1832, p. 56.]

we can hardly believe necessary, but if it was necessary to one forefather, the result
 15 would be as it is. — Hence antelopes at C. of Good Hope and | Marsupials at Australia. —

Will this apply to whole organic Kingdom when our planet first cooled. —

Countries longest separated — greatest differences, — if separated from immersage, possibly two distinct type[s], but each having its representatives — as in Australia

This presupposes time when no mammalia existed; Australia; Mamm[alia] were produced from propagation from different set as the rest of the world. — |

16 This view supposes that in course of ages, and therefore changes, every animal has tendency to change. —

This difficult to prove cats etc. from Egypt no answer, because time short and no great change has happened. —

17 I look at two Ostriches as strong argument of possibility of such | change; as we see them in space, so might they in time. —

As I have before said, *isolate* species, especially with some change, probably vary quicker. —

18 Unknown causes of change. Volcanic island. — Electricity. | Each species changes. Does it progress.

Man gains ideas.

The simplest cannot help becoming more complicated; and if we look to first origin, there must be progress.

If we suppose monads are constantly formed, would they not be pretty similar
 19 over whole world under | similar climates and as far as world has been uniform at former epoch. How on this Ehrenberg?¹

Every successive animal is branching upwards different types of organisation improving as Owen² says simplest coming in and most perfect and others occasionally
 20 dying out; for instance, secondary terebratula may | have propagated recent terebratula, but Megatherium nothing.

We may look at Megatherium, Armadillos and Sloths as all offsprings of some still older type. Some of the branches dying out. —

With this tendency to change (and to multiplication when isolated) requires
 21 deaths of species to keep numbers | of forms equable. But is there any reason for supposing number of forms equable: This being due to subdivisions and amount of differences, so forms would be about equally numerous. —

Changes not result of will of animals, but law of adaptation as much as acid and alkali.

Organized beings represent a tree, *irregularly branched*; some branches far more branched, — hence genera. — As many terminal buds dying, as new ones generated. |
 22 There is nothing stranger in death of species, than individuals.

If we suppose monad definite existence, as we may suppose in this case, their creation being dependent on definite laws; then those, which have changed most,
 23 owing to the accident of positions must in each state of existence have shortest | life. Hence shortness of life of Mammalia. —

¹ Christian Gottfried Ehrenberg. *Die fossilen Infusorien und die lebendige Dammerde*, Berlin 1837.

² Richard Owen. Probably personal communication.

Would there not be a triple branching in the tree of life owing to three elements — air, land and water, and the endeavour of each typical class to extend his domain into the other domains and subdivision[s] three more double arrangement. — | If each main stem of the tree is adapted for these three elements, there will be certainly points of affinity in each branch.

A species as soon as once formed by separation or change in part of country, repugnance to intermarriage — settles it. |

25 ? We need think that fish and penguins really pass into each other. —

The tree of life should perhaps be called the coral of life, base of branches dead, so that passages cannot be seen. — [fig. 1]

26 This again offers | no [] only makes it excessively complicated [] Contradiction to constant succession of genera in progress.



Fig. 1



Fig. 2

Is it thus fish can be traced right down to simple organization. — Birds — not. [fig. 2]

27 | We may fancy according to shortness of life of species that in perfection the bottom of branches deaden, — so that in mammalian tree it would only appear like circles, and insects amongst articulate, — but in lower classes perhaps a more linear arrangement. — |

28 ? How is it that there come aberrant species in each genus (with well characterised parts belonging to each) approaching another.

Petrels have divided themselves into many species, so have the awks [auks], there is particular circumstance, to which. ~

Is it an index of the point, whence two favourable points of organization commenced branching. — |

29 As all the species of some genera have died, have they all one determinate life dependent on genus, the genus upon another, whole class would die out therefore.

30 [remainder of page excised] | [beginning of page excised] In island neighbouring continent where some species have passed over, and where other species have "air" of

31 that place, will it be said those have been then created there: — | Are not all our

British shrews diff[erent] species from the continent. Look over Bell¹ and L. Jenyns.² Falkland rabbit may perhaps be instance of domesticated animals having effected, a change which the Fr[ench] naturalists thought was species. Study Lesson³ — Voyage of Coquille. — |

- 32 Dr Smith⁴ says he is certain that when white man and Hottentots or Negroes cross at C[ape] of Good Hope, the children cannot be made intermediate. The first children partake more of the mother, the later ones of the father ; is not this owing to each copulation producing its effect ; as when bitches' puppies are less purely bred owing to having once born mongrels. He has thus seen the black blood come out from the grandfather (when the mother was nearly quite white) in the two first children. How is this in West Indies — Humboldt,⁵ New Spain. — |

- 33 Dr Smith⁶ always urges the distinct locality or metropolis of every species ; believes in repugnance in crossing of species in wild state. —

No doubt C.D.⁷ wild men do not cross readily, distinctness of tribes in T.del Fuego. The existence of whiter tribes in centre of S. America shows this. — Is there a tendency in plants hybrids to go back? — If so man and plants together would establish law as above stated : no one can doubt that less trifling differences are blended |

- 34 by intermarriages, then the black and white is so far gone, that the species (for species they certainly are according to all common language) will keep to their type : in animals so far removed with instinct in lieu of reason there would probably be repugnance and art required to make marriage. — As Dr Smith⁸ remarked man and wild animals in this respect are differently circumstanced. — |

- 35 ? Is the shortness of life of *species* in certain orders connected with gaps in the *series of connection*? if starting from same epoch certainly. The absolute end of certain forms from considering S. America (*independent of external causes*) does appear very probable : — Mem.: Horse, Llama, etc. etc.

If we grant similarity of animals in one country owing to springing from one branch, and the monucle has definite life, then all die at one period, which is not
∴ MONUCULE NOT DEFINITE LIFE. |

- 36 I think Case must be that one generation then should have as many living as now.

¹ Thomas Bell. *A History of British Quadrupeds*, London 1837. On p. xviii there is a notice pointing out that the *Sorex araneus* of British authors is not the *S. araneus* of the continent. Ellerman & Morrison-Scott (*Checklist of Palaearctic & Indian Mammals*, London 1951, p. 51) accord the status of a geographical race to the British *Sorex araneus castaneus* Jenyns 1838.

² Leonard Jenyns, afterwards Blomefield. *A Manual of British Vertebrate Animals*, London 1835, p. 17 : "incisors deep ferruginous brown" * This circumstance together with one or two others, induces me to suspect that the *S. araneus* of the continental authors may be distinct from ours." This suspicion was verified by Jenyns in his paper "Further remarks on the British shrews", *Ann. Nat. Hist.*, vol. 1, p. 417 ; especially p. 424.

³ René-Primevère Lesson & Prosper Garnot. *Voyage autour du monde . . . sur . . . la Coquille, pendant . . . 1822-1825. Zoologie*, Paris 1826-30.

⁴ Dr, later Sir Andrew Smith. Personal friend of Darwin who met him in South Africa in June 1836.

⁵ Friedrich Heinrich Alexander von Humboldt. *Political essay on the Kingdom of New Spain*, transl. from the original French by John Black, New York 1811.

⁶ Andrew Smith. *Report of the expedition for exploring Central Africa from the Cape of Good Hope, June 23 1834, under the superintendence of Dr. A. Smith*, Cape Town, 1836. Appendix, p. 39 : "most of the species we met with, appeared to have each a natural or chosen domicile, where an evident congregation of its members existed."

⁷ Charles Darwin. *Journal of Researches*, (London 1839), p. 236 : "each [tribe] is surrounded by other hostile ones, speaking different dialects."

⁸ Andrew Smith. Probably personal communication.

To do this and to have many species in same genus (as is), *requires* extinction. [fig. 3]

Thus between A and B immens[e] gap of relation, [between] C and B the finest gradation, [between] B and D rather greater distinction. Thus genera would be
 37 formed, — bearing relation | to ancient types, — with several extinct forms, for if each species as ancient (1) is capable of making 13 recent forms. Twelve of the contemporaries must have left no offspring at all, so as to keep number of species constant. —

With respect to extinction we can easily see that variety of ostrich Petise may not be well adapted, and thus perish out, or on other hand like Orpheus being favour-
 38 able, | many might be produced. This requires principle that the permanent varieties, produced by confined breeding and changing circumstances are continued and produce according to the adaptation of such circumstances, and therefore that

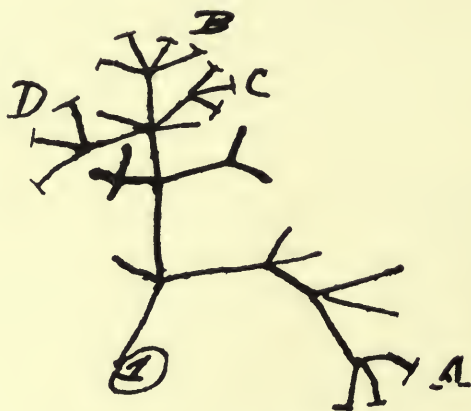


Fig. 3

death of species is a consequence (contrary to what would appear from America) |
 39 of non-adaptation of circumstances. — Vide two pages back Diagram.

The largeness of present genera renders it probable that many contemporary [genera] would have left scarcely any type of their existence in the present world. — Or we may suppose only each species in each generation only breeds, *like* individuals in a country not rapidly increasing. — |

40 If we thus go very far back to look to the source of the Mammalian type of organization, it is extremely improbable that any of the successors of his relations shall now exist. —

In same manner, if we take a man from any large family of 12 brothers and sisters
 41 in a state which does not increase, | it will be chances against any one of them having progeny living ten thousand years hence; because at present day many are relatives, so that by tracing back the fathers would be reduced to small percentage: — therefore the chances are excessively great against any two of the 12 having progeny after that distant period. — |

42 Hence if this is true that the *greater the groups the greater the gaps* (or *solutions of continuous structure*) between them. — for instance, there would be great gap
 43 between birds and mammalia, still greater between | vertebrate and articulate, still greater between animals and plants. —

But yet besides affinities from three elements, from the infinite variations, and all coming from one stock and obeying one law, they may approach—some birds may approach animals and some of the vertebrate invertebrate. — Such or few on
 44 each side will yet present some anomaly and bearing | stamp of some great main type, and the gradation will be sudden. —

Heaven know whether this agrees with Nature : *Cuidado!*

The above speculations are applicable to non-progressive development, which certainly is the case at least during subsequent ages. — |

45 The Creator has made tribes of animals, adapted preeminently for each element, but it seems law that such tribes, as far as compatible with such structure, are in minor degree adapted for other elements. Every part would probably be not complete, if birds were fitted solely for air and fishes for water. —

46 If my idea of origin of | Quinarian system¹ is true, it will not occur in plants which are in far larger proportion terrestrial, — if in any in the Cryptogamic flora. — but not atmospheric type hence probably only four, is not this Fries² rule, what subject has Mr Newman the (7) man³ studied.

The condition of every animal is partly due to direct adaptation and partly to
 47 hereditary taint ; hence the | resemblances and differences, for instance, of finches of Europe and America, etc. etc. etc.

The new system of Natural History will be to describe limits of form (and where possible the number of steps known).

48 Examine good collection of insects with this in view. — | Geogr. Journal. Vol. VI, P. II, p. 89. — Lieut. Wellsted⁴ obtained many sheep from Arabian count[ries]. "These were of two kinds : one white with a black face, and similar to those brought from Abyssinia, and others dark brown, with long clotted hair resembling that of goats". |

49 Progressive development gives final cause for enormous periods anterior to man. Difficult for man to be unprejudiced about self, but considering power, extending range, reason and futurity, it does as yet appear cli. [cut off] |

50 In Mr Gould[s] Australian work⁵ some most curious cases of close but certainly

¹ William Sharp MacLeay. Quinarian theory, see Introduction.

² Elias Magnus Fries. Fries's rule is given in John Lindley : "Some account of the Spherical and Numerical System of M. Elias Fries," *Phil. Mag. & Journ.*, vol. 68, Aug. 1826, p. 81 : "the founder of the system of quaternary arrangement . . . opinions are contained in the Introduction to a work published by M. Fries in 1825, under the title of *Systema Orbis Vegetabilis*."

p. 86 : "When the members of a bipartite section are again dichotomously divided upon analogous principles, four sections are created, of which the first and second, and the third and fourth, are in affinity ; but the first and third, and the second and fourth, are in analogy. But when this method of division becomes circuitous, a more direct path is undoubtedly to be discovered : hence other numbers are admitted, especially the quaternary (or double dichotomy), and also others in which dichotomy is understood." (Reference kindly supplied by W. T. Stearns).

³ Edward Newman. See Introduction.

⁴ Lieutenant R. Wellsted. "Observations on the Coast of Arabia between Rás Mohammed and Jiddah," *Journ. Roy. Geogr. Soc.*, vol. 6, 1836, p. 51, especially p. 89.

⁵ John Gould. *The Birds of Australia and the adjacent Islands*, London 1837.

distinct species between Australia and Van Diemen's land, and Australia and New Zealand. Mr Gould says in subgenera they undoubtedly come from same countries. — In mundane genera |

51-52 excised.

53 | ... and whether extinction of great S. American quadrupeds part of some great system acting over whole world, the period of great quadrupeds declining as great reptiles must have once declined. —

Cuvier¹ (Read his theory of the Earth attentively) objects to propagation of species, by saying, why not have some intermediate forms been discovered between palaeotherium, megalonyx, mastodon and the species now living. — Now, according | to my view, in S. America parent of all armadilloes might be brother to Megatherium — uncle now dead. —

Bulletin Geologique, april 1837, p. 216. Deshayes² on change in shells from Salt and F[resh] Water on what is species. *Very good*. Has not Macculloch³ written on same changes in Fish.

Mem. Rabbit of Falklands described by Q[uoy] and G[aimard]⁴ as new species. Cuvier examined it. |

55-56 excised.

57 ... something occurs with regards to other tribes in that same family. —

(NB. I see Waterhouse⁵ thinks Quinary only three elements.) How far does Waterhouse's representatives agree with breeding in irregular trees and extinction of forms?? It is in simplest case saying every species in genus resembles each other (at least in one point, in truth in all excepting specific character); and in passing from species 58 to genera, each retains | some one character of all its family; but why so? I can see no reason for these analogies; from the principle of atavism, where real structure obliged to be altered, I can conceive colouring retained; therefore probably in some Heteromera colouring of C[h]rysomela may be going back to common ancestor of C[h]rysom[ela] and Heterom[era], but I cannot understand the universality of such law. — |

¹ Georges Cuvier. *Essay on the theory of the earth*, with geological illustrations by Professor Jameson, Edinburgh & London 1817, p. 102: "Why may not the presently existing races of land quadrupeds, ... be modifications of those ancient races which we find in a fossil state; ... If the species have changed by degrees, we ought to find traces of these gradual modifications. Thus, between the palaeotheria and our present species, we should be able to discover some intermediate forms; and yet no such discovery has ever been made."

² Gérard-Paul Deshayes. *Bull. Soc. Geol. France*, vol. 8, 1836 à 1837, Paris 1836 [1837], p. 216: "Dans les espèces tertiaires de la Crimée, les modifications dans les caractères des dents de la charnière sont encore beaucoup plus nombreuses. On y observe une multitude de combinaisons dans la forme, la position, la présence ou l'absence, comme dans le plus ou moins de développement des dents cardinales et latérales, variations que M. Deshayes attribue à un changement de milieu; il pense que d'abord marines, ces coquilles auront continué de vivre dans les eaux douces qui ont remplacé les eaux salées."

³ John MacCulloch. "On the possibility of changing the residence of certain fishes from salt water to fresh", *Quart. Journ. Sci.*, vol. 17, 1824, p. 209.

⁴ Jean-René-Constantin Quoy & Joseph-Paul Gaimard. *Voyage Autour du Monde ... Zoologie*, Paris 1824, contains no description of the Falkland Islands rabbit. But Prosper Garnot: "Remarques sur la Zoologie des îles Malouines, faites pendant le Voyage autour du monde de la Corvette la Coquille," *Ann. Sci. Nat.*, vol. 7, p. 39, contains on p. 42 a description of a rabbit "que nous croyons pouvoir considérer comme une espèce nouvelle bien distincte, et que nous proposons de nommer lapin magellanique, (*Lepus magellanicus* Garnot)."

⁵ George Robert Waterhouse. "Description of some new species of exotic insects," *Trans. Entom. Soc. Lond.*, vol. 2, 1837, p. 188. On p. 190 [His views] "may go a great way to prove or disprove an exceedingly ingenious and favourite theory—I mean the circular and quinary system; for it may happen that in the formation of this theory analogies may in some instances have been mistaken for affinities."

59 It would be curious to know in plants (or animals) whether *races* have tendency to keep to either parent (this is what French call *atavism*). Probably this is first step in dislike to union, offspring not well intermediate.

Lyell,¹ vol. III, p. 379. Mammalian type of organization same from one period to another, preeminently Pachidermata, less so in Miocene and so on. — |

60 As I have traced the great quadruped[s] to Siberia, we must look to type of organization : extinct species of that country — parents of American. — Now genera of these two countries ought to be similar. — |

61 ? Law : existence definite without change, superinduced, or new species. Therefore animals would perish if there was nothing in country to superinduce a change? |

62 Seeing animals[s] die out in S. America with no change, agrees with belief that Siberian animals lived in cold countries and therefore not killed by cold countries.

Seeing how horse and elephant reached S. America, — explain how zebras reached South Africa. —

63 It is a wonderful fact — Horse, Elephant and Mastodon dying out | about same time in such different quarters. — Will Mr Lyell² say that some circumstance killed it [them] over a tract from Spain to S. America? — (*Never*). They die, without they change, like golden Pippins ; it is a *generation* of *species* like generation of *individuals*. — |

64 Why does individual die? To perpetuate certain peculiarities (therefore adaptation), and to obliterate accidental varieties, and to accomodate itself to change (for, of course change even in varieties is accomodation). Now this argument applies to species. — If individual cannot propagate, he has no issue ; so with species. — |

65 I should expect that Bears and Foxes are same in N. America and Asia ; but many species closely allied, but different, because country separated since time of extinct quadrupeds ; — same argument applies to England. — Mem. Sh[r]ew mice |

66 Animals common to South and North America. — ? *Are there any?* |

67 Rhinoceros peculiar to Java and another to Sumatra. — Mem. Parrots peculiar, according to Swainson,³ to certain islets in East India archipelago. —

Dr Smith⁴ considers probable that northern species *replace* southern kinds.

Gnu reaches Orange river and says : so far will I go and no further. — |

68 Prof. Henslow⁵ says that when race once established, so difficult to root out. — For instance ever so many seeds of white flower all would come up white, though planted in same soil with blue. Now this is same bearing with Dr Smith's fact of races of man . . . |

69-70 excised.

71 Strong odour of negroes — a point of real repugnance. —

Waterhouse⁶ says there is no *TRUE connection* between great groups. — |

¹ Charles Lyell. *Principles of Geology*, 5th edition, London 1837, vol. 3, p. 379.

² Charles Lyell. *Principles of Geology*, 5th edition, London 1837, vol. 3, p. 142 : " Successive extinction of species consistent with their limited geographical distribution " (cross-heading) . . . " They must die out ", to borrow an emphatical expression from Buffon ; " because Time fights against them."

³ William Swainson. *A treatise on the geography and classification of animals*, Lardner's Cabinet Cyclopaedia, London 1835, p. 52 : " The suctorial cockatoos of Malacca, the elegant ring-necked parrakeets of the continent, and the crimson-coloured lorries of the islands, are appropriated solely to these regions."

⁴ Andrew Smith. Probably personal communication.

⁵ John Stevens Henslow. Probably personal communication.

⁶ George Robert Waterhouse. Probably personal communication.

- 72 Speculate on land being grouped towards centre near Equator at former periods and then splitting off. —

If *species* generate other *species*, their race is not utterly cut off: — like golden pippins, if produced by seed, go on, — otherwise all die. — The fossil horse generated in S. Africa zebra — and continued, — perished in America. | All animals of same species are bound together just like buds of plants, which die at one time, though produced either sooner or later. — Prove animal[s] like plants: — trace gradation between associated and non-associated animals — and the story will be complete. — |

- 74 It is absurd to talk of one animal being higher than another — *We* consider those, where the { cerebral structure
intellectual faculties } most developed, as highest. — A bee doubtless would where the instincts were [most developed] |

75-76 excised.

- 77 There appears in Australia great abundance of species if few genera or families. — (long separated.) — Proteaceae and other forms (?) being common to Southern hemisphere. Does not look, as if S. Africa peopled from N. Africa. |

- 78 An originality is given (and power of adaptation is given by *true* generation), through means of every step of progressive increase of organization being imitated in the womb which has been passed through to form that species. — |

- 79 Mr Don¹ remarked to me, that he thought species became obscurer as knowledge increased, but genera stronger. Mr Waterhouse² says no real passage between good genera. — How remarkable spines, like on a porcupine or Echidna. —

Good to study Regne animal³ for *Geography*. — |

- 80 The motion of the earth must be excessive up and down. — Elephants in Ceylon. — East India archipelago. — West Indies. — Opossum and Agouti same as on continent — 3 Paradoxusi⁴ in common to Van Diemen's Land and Australia. England and Europe, Ireland — common animals. Ireland longer separate. Hare[s] of two countries different. — Ireland and Isle of Man possessed elk, not England. Did Ireland possess mastodons?? Negative facts tell for little. — From the consideration of these archipelagos ups and downs in full conformity with European formations, — for instance, tertiary deposits between East India islets. — |

- 81 Geographic distribution of Mammalia more valuable than any other, because less easily transported — then plants on coral islets. — Next to animals land birds. — And life shorter or change greater. — In the East Indian Archipelago it would be interesting to trace limits of large animals. — |

- 82 Owls: transport mice alive?

Species formed by subsidence. Java and Sumatra. Rhinoceros. Elevate and join keep distinct, two species made; elevation and subsidence continually forming species. —

The male animal, affecting *all* the progeny of female, insures often mixing of individuals. |

¹ George Don. Probably personal communication.

² George Robert Waterhouse. Probably personal communication.

³ Georges Cuvier. *Le Règne animal*, Paris 1829.

⁴ i.e., platypus (*Ornithorhynchus paradoxus*).

83 South Africa — proof of subsidence and recent elevation : pray ask Dr Smith¹ to state that most clearly. —

Fox² tells me, that beyond all doubt seeds of Ribstone Pippins produce Ribstone Pippins, and Golden Pippins — goldens ; hence *sub-varieties* and hence possibility of reproducing any variety, although many of the seeds will go back. Get instances of a *variety* of fruit tree or plant run wild in foreign country. Here we have avitism the ordinary event and succession the extraordinary. |

84 When one sees nipple on man's breast, one does not say some use, but sex not having been determined ; — so with useless wings under elytra of beetles, born from beetles with wings and modified, — if simple creation, surely would have [been] born without them. — |

85 In some of the lower orders a perfect gradation can be found from forms marking good genera by steps so insensible that each is not more change than we know *varieties* can produce.—Therefore all genera MAY have had intermediate steps. Quote *in detail* some good instance.

86 But it is other question whether there | have existed *all* those intermediate steps, especially in those classes, where species not numerous. (NB. In those classes with few species greatest jumps — strongest marked genera ? Reptiles?). For instance, 87 there never may have been grade between pig and tapir, yet from some | common progenitor. — Now if the intermediate links had produced infinite species, probably the series would have been more perfect, because in each there is possibility of such organization. (Spines in Echidna and Hedgehog.) —

88 As we have one Marsupial animal in Stonesfield slate, the father of all | mammalia in ages long gone past and still more so known with fishes and reptiles. —

In mere eocene rocks we can only expect some steps. — I may ask whether the 89 series is not more perfect by the discovery of fossil Mammalia than before, | and that is all that can be expected. This answers Cuvier.³ —

Perhaps the father of Mammalia as heterodox as Ornithorhynchus. If this last animal bred — might not new classes be brought into play. — |

90 The father being climatized — climatizes the child? — Whether every animal produces in course of ages ten thousand varieties (influenced itself perhaps by circumstances) and those alone preserved which are well adapted? This would account for each tribe acting as in vacuum to each other. |

91 p. 306. — Chamisso⁴ on Kamtchatka quadrupeds. Kotzebues⁵ first Voyage. Entomological Magazine, paper⁶ on Geographical range. Copied with list. Richardson's⁷ Fauna Borealis.

¹ Andrew Smith. " 1836 June 1-15 . . . with Dr A. Smith who has lately returned from his most interesting expedition to beyond the Tropic, I took some long geological rumbles." *Charles Darwin's Diary of the Voyage of the Beagle*, edited by Nora Barlow, Cambridge 1934, p. 409.

² William Darwin Fox. Probably personal communication.

³ Georges Cuvier. *Essay on the Theory of the Earth*, Edinburgh and London 1817, p. 102.

⁴ Adelbert von Chamisso. In *A Voyage of Discovery into the South Sea and Beering's Straits, etc.* by Otto von Kotzebue, (Remarks and Opinions of the Naturalist of the Expedition Chamisso) vol. 3, London 1821, p. 306.

⁵ Otto von Kotzebue. *A Voyage of Discovery into the South Sea and Beering's Straits etc.*, London 1821.

⁶ " Delta ". "Thoughts on the Geographical Distribution of Insects", *Entomol. Mag.*, London 1835, vol. 2, pp. 44, 280.

⁷ Sir John Richardson. *Fauna Boreali-Americana ; or the zoology of the northern parts of British America*, London, 1829-1837.

It is important the possibility of some islands not having large quadrupeds. — |
 92 Humboldt¹ has written on the geography of plants : *Essai sur la Géographie des Plantes*. I vol. in 4°.

I have abstracted Mr Swainson's² tract at beginning of Volume on geographical distribution of animals. |

93 Geograph. Journal,³ vol. I, p. 17-21, says from Swan river long south coast, all the remarkable Australian genera collected together. —

Man has no *hereditary prejudices* or wishes to conquer or breed together. — Man has no limits to desire, in proportion instinct more, reason less, so will aversion be. |

94 L'Institut,⁴ 1837, No. 246, a section of fossil "singé", it cannot be made to approach the Colobus, which in South Africa appear to represent the semnopithecus of India. — Tooth of Sapajou, — NB. Sapajou is S. American form : therefore it is
 95 like case of great edentate (has been doubted?) | and opossum, found in Europe, now confined to southern hemisphere. — If these facts were established it would go to show a *centrum* for Mammalia. — I really think a very strong case might be made out of world before Zoological divisions.

Man : species doubtful when known only by bones.

Mem. Silurian fossils :? how are South American shells? |

96 Do not plants, which have male and female organs together, yet receive influence from other plants — Does not Lyell⁵ give some argument about varieties being difficult to keep on account of pollen from other plants because this may be applied to show all plants do receive intermixture. — But how with hermaphrodite shells!!!? |

97 We have not the slightest right to say, there never was common progenitor to mammalia and fish, when there now exist such strange forms as ornithorhync[h]us. —

The type of organization constant in the shells. — |

98 The question if creative power acted at Galapagos, it so acted that birds with plumage and tone of idea purely American, North and South, — so permanent a breath cannot reside in space before island existed. — Such an influence must exist in such spots. We know birds do arrive and seeds. (And geographical division are arbitrary and not permanent. This might be made very strong if we believe

¹ Friedrich Heinrich Alexander von Humboldt. *Essai sur la géographie des plantes*, Paris 1805. [= Vol. 2 Part V of Humboldt, F. H. A. von, & Bonpland, A. J. A.:— *Voyage aux régions équinoxiales du Nouveau Continent, fait en 1799-1804*, Paris 1805-1837].

² William Swainson. *A Treatise on the Geography and Classification of Animals*. Lardner's Cabinet Cyclopaedia, London 1835, chapter I.

³ Robert Brown. "General view of the botany of the vicinity of Swan River," *Journ. Roy. Geogr. Soc.*, vol. 1, p. 18; "this portion of the shores of New Holland, extending from Swan River on the West coast to Middle Island . . . on the south coast, may be said to contain the greatest proportion of those genera which form the chief peculiarities of New Holland Vegetation."

⁴ William Martin. *L'Institut*, Paris vol. 6, 1838, No. 246, p. 300. [This paper was not published until 13th September 1838. It refers to a paper read before the Zoological Society of London on 11th July 1837: "Mr. Martin then laid before the meeting the following observations on the Proboscis Monkey, or 'Guenon à long nez'" *Proc. Zool. Soc. Lond.*, Part V, 1837, p. 70. There is no number 246 of the *Institut* in 1837. Darwin's reference therefore must be incorrect. The paper referred to here contains no reference to fossil monkeys. There are several references to fossil monkeys in *L'Institut* in 1837, but none on page 246, and none refers to *Colobus*.]

⁵ Charles Lyell. *Principles of Geology*, London 1832, vol. 2, p. 33: varieties of cultivated plants cannot originate nor be maintained without the intervention of man, because "it is only by strong manures that these varieties have been obtained, and in poorer soils they instantly degenerate." But even if the manure supply were kept up by herds of wild animals the varieties could not be maintained because of cross-pollination.

the Creator creates by any laws, which I think is shown by the very facts of the geological character of these islands.) |

- 99 The same remarks applicable to fossil animals same type, — armadillos like every created [edentate]. — Passage for vertebrae in neck — same cause ; such beautiful adaptation, yet other animals live so well. — This kind of propagation gives hiding-place for many unintelligible structures — it might have been of use in progenitor, or it may be of use, — like mammae on men's breast. — |
- 100 How does it come wandering birds such [as] sandpipers not new at Galapagos. — Did the creative force know these species could arrive — did it only create those kinds not so likely to wander — did it create two species closely allied to Mus[cicapa] coronata, but not coronata. — We know that domestic animals vary in countries without any assignable reason. |
- 101 Astronomers might formerly have said that God ordered each planet to move in its particular destiny. In same manner God orders each animal created with certain form in certain country, but how much more simple and sublime power let attraction act according to certain law, such are inevitable consequences — let animal be created,
- 102 then by the fixed laws of generation, such will be their successors. | Let the powers of transportal be such, and so will be the forms of one country to another. — Let geological changes go at such a rate, so will be the number and distribution of the species!! |
- 103 It may be argued representative species chiefly found where barriers or what are barriers by interruption of communication, or when country changes. Will it [be] said that volcanic soil at Galapagos under equator, that external conditions would produce species so close as Patagonian and Galapagos Orpheus. — Put this strong so many thousand miles distant. — |
- 104 Absolute knowledge that species die and others replace them. — Two hypotheses : fresh creations is mere assumption, it explains nothing further ; points gained if any facts are connected.¹ —
- No doubt in birds ; mundane genera are birds, (bats, foxes, Mus) that are apt to
- 105 wander and of easy transportal. — Waders and | waterfowl — scrutinize genera and draw up tables. — Instincts may confine certain birds which have wide power of flight ; but are there any genera, mundane, which cannot transport easily. It would have been wonderful if the two Rhea had existed in different continents. — In plants I believe not. — |
- 106 It is a very great puzzle why Marsupials and Edentata should only have left offsprings in or near South Hemisphere. Were they produced in several places and died off in some? Why did not fossil horse breed in S. America. It will not do to say period unfavourable to *large* quadrupeds, horse not large. — |
- 107–108 *excised*.
- 109 . . . but not vice versa. (Could plants live without carbonic acid gas. Yet unquestionably animals most dependent on vegetables of the two great kingdoms. |
- 110 Principes de Zool. Philosoph.² : — I deduce from extreme difficulty of hypothesis

¹ This is an early appearance of the argument frequently used by Darwin to the effect that the value of a hypothesis increases with the number of facts which it explains.

² Etienne Geoffroy-Saint-Hilaire. *Principes de Philosophie Zoologique*, Paris 1830, pp. 54 ff. (hypothesis that Cephalopod molluscs provided a link between invertebrates and vertebrates).

of connecting mollusca and vertebrata, that there must be very great gaps. — Yet some analogy. The existence of plants and their passage to animals appears greatest argument against theory of analogies. |

- III [Saint-Hilaire] states there is but one animal,¹ one set of organ[s]; the others [he] assumes CREATED with endless differences: — does not say propagated, but must have concluded so — Evidently or hints considers generation as a short process by which one animal passes from worm to man highest or typical of changes which can be traced in *same* organ in *different* animals in scale. — In monsters also organs |
 II2 of lower animals appear. — Yet nothing about propagation — I see nothing like grandfather of Mammalia and birds — &c.

p. 32, reference to Milne Edwards² law of crustacea with respect to mouth, those beautiful passages from one to other organ. — Cuvier³ on opposite side; 1st vol of Fish.

p. 59. Cuvier⁴ has said each animal made for itself does not agree with old and modern types being constant. Cuvier's⁵ theory of *Conditions* of existence is thought to account [for] resemblances and ∴ quinary system, on three elements. p. 66. |

- II3 With unknown limits, every tribe appears fitted for as many situations as possible; conditions will not explain states, for instance, take birds, animals, reptiles, fish. — (Perhaps consideration of range of capabilities past and present might tell something.)

p. III. G. St. Hilaire Insects and Molluscs allowed to be wide hiatus: states in one the sanguineous system, in other nervous developed.⁶ (Owen's idea). States these class[es] approach on the confines? Balanida? I cannot understand whether S.H. thinks development in quite straight line or branching. — |

- II4 S.H. What does the expression mean used by Cuvier,⁷ that all animals (though

¹ Etienne Geoffroy-Saint-Hilaire. *Principes de Philosophie Zoologique*, Paris 1830, p. 22: "il n'est plus d'animaux divers. Un seul fait les domine, c'est comme un seul être qui apparaît." *Ibid.* p. 214: "Il n'y a donc pas plusieurs animaux, à proprement parler, mais un seul animal, dont les organes varient dans la forme, l'usage et le volume, mais dont les matériaux restent toujours les mêmes, au milieu de ces surprenantes métamorphoses."

² Henri Milne-Edwards. "Sur l'organisation de la bouche chez les crustacés suceurs (1830) *Ann. Sci. Nat.*, vol. 28, 1833, p. 78: transformation of normal mouth with mandibles and maxillae into sucking tube, elongated, but "la composition organique décrite est toujours restée analogique. Les mêmes éléments constitutifs sont retrouvés dans l'un et l'autre cas; c'est une tendance remarquable à l'uniformité de composition."

³ Georges Cuvier. Darwin made this note from E. Geoffroy-Saint-Hilaire's *Principes de Philosophie Zoologique*, Paris 1830, p. 57, where Cuvier is quoted as saying "Tout nouvellement encore, dans le premier volume de mon *Histoire des Poissons*, j'ai exprimé mon sentiment à ce sujet, sans doute avec le ton modéré que les sciences réclament, et avec la politesse qui appartient à tout homme bien élevé."

⁴ Georges Cuvier. Darwin made this note from Geoffroy-Saint-Hilaire; *Principes de Philosophie Zoologique*, Paris 1830, p. 59 where Cuvier's earlier article on "Nature", in Levrault's *Dictionnaire des sciences naturelles* is quoted:—" Ces vues d'unité sont renouvelées d'une vieille erreur née au sein du panthéisme, étant principalement enfantée par une idée de causalité, par la supposition inadmissible que tous les êtres sont créés en vue les uns des autres; cependant chaque être est fait pour soi."

⁵ This reference appears to be to Etienne Geoffroy-Saint-Hilaire, *Principes de Philosophie Zoologique* p. 66 on which there is a footnote by St Hilaire (referring to *Conditions*) on Cuvier's argument about resemblance.

⁶ Etienne Geoffroy-Saint-Hilaire. *Principes de Philosophie Zoologique*, Paris 1830, p. 111: "Le système sanguin est en excès et au contraire le système nerveux est frappé d'atrophie chez les mollusques; c'est l'inverse chez les insectes." Loi de compensation.

⁷ Georges Cuvier. Darwin appears to be quoting from E. Geoffroy-Saint-Hilaire *Principes de Philosophie Zoologique*, Paris 1830, p. 56 where Cuvier is quoted as saying: "j'ai toujours soutenu que le plan, qui jusqu'à un certain point est commun aux vertébrés, ne se continue pas chez les mollusques." Cf. also *Le règne animal*, Paris 1829, vol. 1 p. 48: "on trouvera qu'il existe quatre formes principales, quatre plans généraux, si l'on peut s'exprimer ainsi, d'après lesquels tous les animaux, semblent avoir été modelés."

some may be) have not been created on the same plan. ("Second resumé" well worth studying). H.¹ says grand idea God giving laws and on them leaving all to follow consequences. —

I cannot make out his ideas about propagation. His work *Philosophie anatomique* (2d vol. about monsters² worth reading.) |

- 115 NB. Well to insist upon large mammalia not being found on all islands (if act of fresh creation, why not produced on New Zealand; if generated, an answer can be given). —

It is a point of great interest to prove animals not adapted to each country. —

- 116 Provision for transportal otherwise not so numerous: quoted from Lyell³; | assuming truth of quadrupeds being created on small spots of land of the same type with the great continents, we get a means of Knowing of movements. —

- How can we understand, excepting by propagation, that out of the thousand of
117 new insects all belong to same | types already established. Why out of the thousands of forms should they all be classified. Propagation explains this. —

Ancient Flora thought to [be] more uniform than existing.⁴ — Ed. n. *Philos. J.*, p. 191, No. 5, [vol. 3] Apr. 1827. |

- 118 F. Cuvier⁵ says: "But we could only produce domestic individuals and not races, without the occurrence of one of the most general laws of life — the transmission of a fortuitous modification into a durable form, of a fugitive want into a fundamental propensity, of an accidental habit into an instinct". Ed. n. *Phi. J.*, p. 297, No. 8, Jan.-Apr. 1828. — I take higher grounds and say life is short for this object and others, viz. not too much change. |

- 119 In number 6 ? of Ed. n. *Phil. Journ.* Paper by Crawford⁶ on Mission to Ava, account of HAIRY (because ancestors hairy) man with one hairy child, and of *albino* DISEASE being banished, and given to Portuguese priest. — In first settling a country, people very apt to be split up into many isolated races! Are there any instances of peculiar people banished by rest? — ∴ Most monstrous form has tendency to propagate as well as diseases. |

¹ Etienne Geoffroy-Saint-Hilaire, *Principes de Philosophie Zoologique*, Paris 1830, p. 219: "La puissance créatrice, par des combinaisons aussi simples a produit l'ordre actuel de l'univers, quand elle eut attribué à chaque chose sa qualité propre et son degré d'action, et qu'elle eut réglé que tant d'éléments, ainsi sortis de ses mains, seraient éternellement abandonnés au jeu, ou mieux, à toutes les conséquences de leurs attractions réciproques." This concept appears in the *Sketch* of 1842, (p. 86), *Essay* of 1844 (p. 253), and the *Origin* (World's Classics Edition p. 559).

² Etienne Geoffroy-Saint-Hilaire. *Philosophie anatomique. Des Monstruosités humaines*, Paris 1822. In referring to "2nd vol.", Darwin was regarding the work *Philosophie anatomique*, Paris 1818 as vol. 1.

³ Charles Lyell. *Principles of Geology*, vol. 2, London 1832, chapters VI and IX, 5th edition, London 1837, chapters VIII and IX.

⁴ Anonymous. "Scientific intelligence. 9. On the distribution of living and fossil plants." *Edin. New. Phil. Journ.* vol. 3, April-June 1827, p. 190. On p. 191: "the same genera and species [of fossil plants] are found in the most remote regions where the plants now in existence are entirely different."

⁵ Frédéric Cuvier (1773-1838, brother of Baron Georges Cuvier). "Essay on the domestication of mammiferous animals . . ." *Edin. new. Phil. Journ.*, vol. 4, April 1828, p. 297.

⁶ John Crawford. "Account of Mr. Crawford's Mission to Ava." *Edin. new. Phil. Journ.*, vol. 3, July-September 1827, p. 359. On p. 368: "a man covered from head to foot with hair . . . The hair on the face of this singular being, the ears included, is shaggy, and about eight inches long . . . has two daughters . . . the youngest is covered with hair like her father . . . Albinos occur, now and then . . . We saw two examples: one of these, a young man of twenty . . . They were ashamed of him, and considered him little better than a European, they made him over to the Portuguese clergy man."

- 120 In intermarriages: smallest differences blended, rather stronger tendency to imitate one of the parents; repugnance generally to marriage before domestication, afterwards none or little with fertile offspring; marriage never probably excepting from strict domestication, offspring not fertile or at least most rarely and perhaps never female. — No offspring: physical impossibility to marriage. — |
- 121 ? Whether those genera which unite very different structure as *petrel* and *alk* do not show the possibility of common branching off?
Accra,¹ Coast of Africa. Clay slate, strike SSW and NNE, and 30°–80° C°. — Ed. Phil. n. J., p. 410, 1828 |
- 122 It is daily happening, that naturalist[s] describe animals as species, for instance — Australian dog or Falkland rabbit. — There is only two ways of proving to them it is not; one when they can proved descendant, which of course most rare, or when placed together they will breed. — But what a character is this? — |
- 123–128 excised.
- 129 The relation of analogy of MacLeay² etc. appears to me the same as the irregularities in the degradation of structure of Lamarck,³ which he says depends on external influences. — For instance he says wings of bat are from external influence. — |
- 130 Hence name of analogy, the structures in the two animals bearing relation to a third body, or common end of structure.
A Race of domestic animals made from influences in one country is permanent in another. — Good argument for species not being so closely adapted. |
- 131 Near the Caspian province of Ghilan wooded district, cattle with humps⁴ as in India. Geograph. J. — Vol. III, P. 1, p. 17, (Lat. about 37°). Vol. IV, P. 1, Geograph. Journal. Voyage up the Massaroony by W. Hillhouse.⁵ — Demerara. In note Demerara 10–12 feet beneath surface forest trees fallen, kind well known, carbonized; clay, fifty feet, then forest 120 ft., micaceous rocks; subsidence appears indicated. — p. 36. — |
- 132 Geograph. Journ., Vol. IV, P. II, p. 160. Melville Island: "the buffaloes, introduced from Timor, herded separate from the English cattle, nor could we get them to associate together".⁶ |

¹ Thomas Park. In "Scientific intelligence: Mr. Thomas Park's journey into the interior of Africa," *Edin. new Phil. Journ.*, vol. 4, March–April 1828, p. 410.

² William Sharp MacLeay. *Horae Entomologicae*, London 1819–1821. The "relations of analogy" are conceived as "existing between corresponding points of the two contiguous circles which pass through a perfect change of form" (p. 391) e.g. the Decapoda in the Crustacean circle have "relations of analogy" with the Araneidea of the Arachnid circle, while the latter's Acaridea have "relations of analogy" with the Diptera of the Haustellata circle.

³ Jean-Baptiste de Lamarck. *Philosophie Zoologique*, Paris 1809, vol. 1, p. 153: degradation is the result of less progress in the perfection and composition of the organization, and must be distinguished from the effects of environment and contracted habits. E.g., seals owe their imperfect limbs to the water in which they live, as do whales; but seals are less degraded than whales because their organization is less degraded in its essential parts.

⁴ Colonel William Monteith. "Journal of a tour through Azerdbijan and the shores of the Caspian," *Journ. Roy. Geogr. Soc.*, vol. 3, 1834, p. 1. On p. 17: "Their features more resemble Indians, and the cattle are small, having also the hump peculiar to that country."

⁵ William Hillhouse. "Journal of a voyage up the Massaroony in 1831." *Journ. Roy. Geogr. Soc.*, vol. 4, 1834, p. 25.

⁶ Major Campbell. "Geographical memoir of Melville Island, and Port Essington on the Coburg Peninsula Northern Australia . . ." *Journ. Roy. Geogr. Soc.*, vol. 4, 1834, p. 129 (160).

- 133 There is long rigmarole articles by S. Hilaire¹ on wonder of finding monkey in France — of genus peculiar to East Indian isles. — Compares it to fossil Didelphis (S. American genus) in plaster of Paris. — Now this is exception to *law of type*, like horse in S. America or like living Edentata in Africa etc. etc. — Now if suppose
 134 world more perfectly continental, we might have | wanderers (as Peccari in N. America); then if it is doomed that only one species of family has offspring the *chance* is that these wanderers would not, but where original forms most numerous,
 135 there would be wanderers. — Some however might have offspring, and then | (v. L'Institut,² p. 245 [recte 243], 1837) we should have anomalies, as Cape anteater. — This supposes world divided into Zoological provinces, united — and now divided again. — Weakest part of theory death of species without apparent physical cause. — Mem.: Mastodon all over S. America. Hilaire³ does not seem (?) to consider the monkey as a wanderer, but as produced by climate? — |
 136 M. Baer⁴ (thinks) the Auroch was found in Germany and thinks even now in central and eastern Asia beyond the Ganges and perhaps even in India — p. 261, L'Institut, 1837.
 Mem.: F[ox] Darwin⁵ cross breed boars were wilder than parents, which is same as Indian Cattle. Tameness not hereditary? Having been gained in short time. |
 137 Milvulus forficatus is a great flycatcher doing the service of a swallow.
 I think we may conclude from Australia and S. America, that only some mundane cause has destroyed animals over the whole world. — For instance, gradual reduction of temperature from geographical or central heat. — But the shells. |
 138 Mr Yarrell⁶ says that old *races* when mingled with newer, hybrid variety partakes chiefly of the former. Eyton's⁷ paper on Hybrids, Loudon's Magazine. Gould⁸ on Motacilla Loudon's Mag., September or October 1837 species peculiar to Continent and England. |

¹ Etienne Geoffroy-Saint-Hilaire. "Singe fossile de Sansan", *L'Institut*, 5, 1837, p. 242: "Ce n'est point un singe généralement parlant que M. Lartet a découvert dans notre Europe, mais précisément l'analogue de l'une de ces formes qu'on ne rencontre que dans cette région décidément à part, où la spécialité d'essences animales propres aux Indes Orientales et soumises à l'influence d'un milieu ambiant d'une sorte déterminée."

² Darlu. *L'Institut*, Paris 5, 1837, 218, p. 245. This paper deals with fossil mammals in deposits of gypsum near Meaux and contains no reference to the wanderings of mammals, nor to their anomalous distribution. Darwin's reference must therefore be incorrect, and should read p. 243: cf. next footnote.

³ Etienne Geoffroy-Saint-Hilaire. *L'Institut*, vol. 5, 1837, p. 243: "n'allez pas conclure qu'en recourant à l'accumulation hypothétique des siècles, vous finiriez par construire une route géographique bien servie par la nature des diverses températures, immédiatement à ce propices, afin que les espèces, Sarigue et Gibbon, aujourd'hui vivantes en leur contrée respective, aient fourni des voyageurs vers un point voisin de leur antipode et soient venus ainsi déposer en France les débris, juste sujet de notre admiration, que nous avons cités dans cet écrit; non, il n'en est point ainsi. Je m'en tiens pour dénégation, quant à ce sujet, aux principes et aux données philosophiques de mes mémoires sur les milieux ambiants . . ."

⁴ N. Baer. "Aurochs du Caucase" *L'Institut*, Paris, 5, 1837, 218, p. 260.

⁵ William Darwin Fox. Probably personal communication.

⁶ William Yarrell. Probably personal communication.

⁷ Thomas Campbell Eyton. "Some remarks upon the theory of hybridity", *Mag. Nat. Hist. N.S.*, vol. 1, 1837, p. 357.

⁸ John Gould. "Observations on some species of the genus *Motacilla* of Linnaeus." *Mag. Nat. Hist.*, vol. 1, September 1837, p. 459. Distinction between *Motacilla flava* Ray of Britain and *M. neglecta* of France and Holland. The pied wagtail of Britain, Norway and Sweden, has its place taken in France by *M. alba* L. *M. lugubris* Pallas is restricted to eastern Europe.

- 139 Westwood¹ has written paper on affinity and analogy in Linnaean Transactions.
 Mr Wynne² distinctly says that the mixture between Chinese and English Breed decidedly exceedingly prolific, and hybrid about half way. Eyton³ says Hybrid about half ways [way], and results the same. Indian cattle and common produced
 140 very fine | hybrid offspring, much larger, than the dom[estic] from those imported by L[ord] Powis. Hybrid dogs offspring seldom intermediate between parents. — How easily does Wolf and Dog cross? Mr Yarrel⁴ thinks oldest variety impresses the offspring most forcibly. Esquimaux dog and pointer.
 Game-fowls have courage independently of individual force. |
 141 Mr Wynne⁵ has crossed Duck and Widgeon, and offspring either amongst themselves or with parent birds.
 W. [Darwin] Fox⁶ knew of case of male widgeon winged and turned on pool; first season bred readily with common ducks.
 Kirby⁷ all through Bridgewater errs greatly in thinking every animal born to consume this or that thing. — There is some much higher generalization in view.
 In Marsupial division do we not see — splitting in orders carnivora, rodents etc. JUST COMMENCING. |
 142 Kirby⁸ says (not definite information) west of Rocky Mountains asiatic types discernible. — Bridgewater Treatise, p. 85. Parasites of negroes different from European.⁹ — Horse and ox have different parasites in different climates. — Humb[oldt],¹⁰ Vol. V, P. II, p. 565. Consult. Says types most subject to vary where intermixture precluded. — |
 143 Kirby¹¹ Bridgewater Treatise. There are some good accounts of passages of legs

¹ John Obadiah Westwood. "On Diopsis, a Genus of Dipterous insects", *Trans. Linn. Soc. Lond.* vol. 17, 1837, p. 283. On p. 285: "as these instances* involve in some degree the doctrine that every affinity is connected with, and must be tested by, a corresponding analogy . . ." (* footnote: lateral prolongation of the head into ocular peduncles).

² Wynne. Untraced.

³ Thomas Campbell Eyton. "Some Remarks upon the Theory of Hybridity", *Mag. Nat. Hist.*, N.S., London 1837, vol. 1, p. 357.

⁴ William Yarrell. Probably personal communication.

⁵ Wynne. Untraced.

⁶ William Darwin Fox. Probably personal communication.

⁷ William Kirby. *On the power, wisdom, and goodness of God, as manifested in the creation of animals and in their history, habits, and instincts*, (The Bridgewater Treatises) London 1835, vol. 1, p. 141: "There is another function which is devolved upon animals with respect to the vegetable kingdom: to keep the members of it within due limits" vol. 2, p. 496: "the vegetable tenants of the ocean require to be kept within due limits, . . . amongst other creatures to whom this province is assigned, are some Crustacea." vol. 2, p. 514: "The general functions of this Order [Carnivora] are to check the tendency to increase not only in their own Class, the Mammalians, but in most of the other Classes of Animals."

⁸ William Kirby, *op. cit.* vol. 1, p. 52: "On the Rocky Mountains, and in the country westward of that range, Asiatic types are discoverable, both in the vegetable and animal kingdoms."

⁹ William Kirby. *op. cit.* vol. 1, p. 85: "Little stress will be laid on the parasite of the negroes (*Pediculus Nigritarum*), being specifically distinct from that which infests the whites, when we reflect that the horse and the ox have different parasites and assailants in different climates."

¹⁰ Friedrich Heinrich Alexander von Humboldt. *Personal Narrative of Travels to the Equinoctial Regions of the New Continent, during the years 1799-1804*, translated by Helen Maria Williams, London 1821, vol. V, p. 565: "The exclusion of all foreign mixture contributes to perpetuate varieties, or the aberrations from a common standard."

¹¹ William Kirby. *op. cit.* vol. 2, p. 75: "in this Order of the Myriapods we see the first tendency towards employing what in Hexapods wear the form and perform the functions of legs as auxiliaries of the mouth."

into mouthpieces of Crustacea. Vol. II, p. 75. A Fish which emigrates over land,¹ a silurus, p. 123. A climbing fish,² p. 122. A terrestrial annelidous animal,³ p. 347, Vol. I. — compare with my planariae.⁴ Leaches out of water. |

144 Does the odd Petrel of T. del F. take form of awk because there is no awk in Southern Hemisphere? Does this rule apply? |

145 A Treatise on Form of Animals by Mr Cline:⁵ "The character of both parents are observed in their offspring, but that of the male more frequently predominates". p. 20 ditto: "If hornless ram be put to horned ewe almost all the lambs will be hornless". Does this apply to when same animal breeds often with same male.

p. 23 "It is wrong to enlarge a native breed of animals, for in proportion to their increase of size they become worse in form, less handy, and more liable to disease". |

146 If population of place be constant, say 2000, and at present day every ten living souls on average are related to the (2000th year) degree, then 200 years ago there were 200 people living who now have successors. Then the chance of 200 people, being related within 200 years backward, might be calculated and this number eliminated; say 150 people four hundred years since were progenitors of present people, and so on backwards to one progenitor, who might have continued breeding from eternity backwards. — |

147 If population was increasing between each lustrum, the number related at the first start must be greater, and this number would vary at each lustrum and the calculation of chance of the relationship of the progenitors would have different formula for each lustrum. We may conclude that there will be a period, though long distant, when of the present men (of all races) not more than a few will have

148 successors. At present day in looking at two fine families one will | [have] successors for centuries, the other will become extinct. —

Who can analyse causes, dislike to marriage; hereditary disease, effects of contagions and accidents; yet some causes are evident as, for instance, one man killing another. — So is it with *varying* races of man: then races may be overlooked mere variations consequent on climate etc. — the whole races act towards each other and are acted on, just like the two families no doubt a different set of causes must act in the two cases. —

¹ William Kirby. *op. cit.* vol. 1, p. 122: "Another migrating fish was found by thousands in the ponds and all the fresh waters of Carolina, by Bosc; and as these pools are subject to be dry in summer, the Creator has furnished this fish, as well as one of the flying ones (*Exocoetus*), by means of a membrane which closes its mouth, with the faculty of living out of water, and of travelling by leaps, to discover other pools."

² William Kirby. *op. cit.* vol. 1, p. 123: "Another fish (*Perca scandens*), found by Daldorff, in Tranquebar, not only creeps upon the shore, but even climbs the Fan palm in pursuit of certain Crustaceans which form its food."

³ William Kirby. *op. cit.* vol. 1, p. 347: "My late indefatigable and talented friend, the Rev. L. Guilding once found a *land* species, in an ancient wood in the Island of St. Vincent's, which from its soft body he regarded as a Molluscan, but from its figure, and annulose structure, its jointed antennae, and seemingly jointed legs crowned with bristles, it (*Peripatus juliformis*) certainly belongs, as Mr. Gray has remarked, to the present class [Annelida]."

⁴ Charles Darwin. *Journal of Researches*, London 1839, p. 30: "The terrestrial Planariae, of which I have found no less than eight species, occur from within the tropic to lat. 47° south, and are common to South America, New Zealand, Van Diemen's Land, and Mauritius."

⁵ Henry Cline. *On the form of animals*, London 1805. *Observations on the Breeding and Form of Domestic animals*, London 1829.

May this not be extended to all animals, first consider species of cats etc. etc. Exclude mothers and then try this as simile. |

- 149 In a decreasing population at any one moment fewer closely related, $\therefore$ (few species of genera) ultimately few genera (for otherwise the relationship would converge sooner), and lastly perhaps some one single one.— Will not this account for the odd genera with few species which stand between great groups, which we are bound to consider the increasing ones. —

NB. As illustration are there many anomalous lizards living, or of the tribes fish extinct, or of Pachydermata, or of coniferous trees, or in certain shell cephalopoda. — Read Buckland.¹ |

- 150 L'Institut, 1837, p. 319. Brongniart² — no dicotyledonous plants and few monocot [yledonous] in coal formation? p. 320. States cryptogam[ic] Flora formerly common to New Holland?! p. 320. Says Coniferous structure intermediate between vascular or Cryptogam (original Flora) and Dicotyledones, which nearly first appear (p. 321) at Tertiary epochs. p. 330. Fossil Infusoria found of unknown forms, a circumstance undiscovered by Ehrenberg.³ — |

151-154 excised.

- 155 . . . Indian cow with hump and common ; — between Esquimaux and European dog? Yet man has had no interest in perpetuating these particular varieties.

If species made by isolation, then their distribution (after physical changes) would be on rays — from certain spots. — Agrees with old Linnaean⁴ doctrine and Lyell's⁵ to certain extent. |

- 156 Von Buch⁶ — Canary Islands : French Edit. — Flora of Islands very poor (p. 145) : 25 plants [Tristan da Cunha]. 36 St. Helena without ferns. — Analogous to nearest continent ; poorness in exact proportion to distance (?) and similarity of type (?) (Mem.: Juan Fernandez⁷). From study of Flora of islands : "ou bien encore on pourrait au plus en conclure quels sont les genres qui, sous ce climat, se divisent le plus aisément en espèces distinctes et permanentes", p. 145. In Humboldt⁸ great

¹ William Buckland. *Geology and Mineralogy considered with reference to Natural Theology*, London 1836.

² A. Brongniart. "Végétaux fossiles", *L'Institut*, Paris 5, 1837, 220, p. 318.

³ Christian Gottfried Ehrenberg. *L'Institut*, Paris 5, 1837, p. 330 : "Paléontologie : infusoires fossiles du tripoli d'Oran. M. Ehrenberg communique l'extrait d'une lettre de M. Agassiz de Neuchâtel sur le tripoli d'Oran qu'il a reconnu être formé de corps organisés microscopiques et silicifiés."

⁴ Carolus Linnaeus. "Oratio de telluris habitabilis incremento", reprinted in *Amoenitates Academicæ*, vol. 2, contains a hypothesis of diffusion of plants and animals from the Island of Paradise. It is probable that Darwin's source was the English translation by F. J. Brand : *Select dissertations from the Amoenitates Academicæ*, London 1781. (Information kindly supplied by W. T. Stearn ; cf. his "Botanical Exploration to the time of Linnaeus", *Proc. Linn. Soc. Lond.*, 169 Session 1956-7, London 1958, especially pages 193 and 194).

⁵ Charles Lyell. *Principles of Geology*, vol. 2, London 1832, p. 126.

⁶ Leopold von Buch. *Description physique des Iles Canaries*, par Léopold de Buch traduite de l'Allemand par C. Boulanger, Paris 1836, p. 144 : "Le célèbre naturaliste français Du Petit-Thouars ne trouve, sur l'île de Tristan d'Acunha . . . pas plus de 25 différentes espèces de plantes phanérogames, dont les unes rappellent la végétation du Cap, les autres celle de l'Amérique, à peu près également distante, et leur nombre à Sainte-Hélène, d'après le Catalogue de Risburgh, ne monte pas à plus de 36 espèces."

⁷ Charles Lyell. *Principles of Geology*, vol. 2, London 1832, p. 154 has a reference to the introduction of goats into Juan Fernandez.

⁸ Friedrich Heinrich Alexander von Humboldt. *De Distributione geographica plantarum secundum coeli temperiem et altitudinem montium, prolegomena*, Lutetiae Parisiorum, 1817, p. 39 : "si, in singula zona, *specierum numerum cum numero generum confers, cui illae adscribuntur, tum versus polum, tum versus cacumina montium, longe plura genera invenies, quam locis planis et calidioribus. Sic alit Gallia inter 3645 species phanerogamas 683 genera, cum in Laponia 487 Phanerogamae ad 212 genera referuntur ; unde rationes fiunt 5, 7 : 1 et 2, 3 : 1."*

157 work | De distribut. plantarum relation of genera to species in France is 1 : 5·7, in Laponia 1 : 2·3. Mem.: Lyell¹ on shells. —

	genera
In North Africa	1 : 4·2
Iles Canaries	1 : 1·46
St. Helena	1 : 1·15

Calculate my Keeling case; Juan Fernandez; Galapagos. — Radack Islands. —
158 ∴ Islands and Arctic are in same relation. We find | species few in proportion to difficulty of transport. For instance, the temperate parts of Teneriffe: the proportion of genera 1 : 1. I can understand in one small island species would not be manufactured. Does it not present analogy to what takes place from time? Von Buch² distinctly states that permanent varieties become species, p. 147–150, — not being crossed with others. — Compare it to languages. But how do plants cross? — Admirable discussion. |

159–160 excised.

161 Mr Owen³ suggested to me, that the production of monsters (which Hunter⁴ says owe their origin to very early stage) and which follow certain laws according to species, present an analogy to production of species. —

Animals have no notion of beauty, — therefore instinctive feelings against other species for sexual ends, whereas man has such instincts very little. |

162 In Zoolog. Proceedings, June 1837, by Eyton⁵ account of three kinds of pigs. Difference in skeletons: VERY GOOD.

Apteryx, a good instance probably of rudimentary bones. — As Waterhouse⁶ remarked mere length of bill does not indicate affinity because similar habits produce similar structure. — Mem.: Ornithorhync[h]us.

Would not *relationship* express a real affinity and affinity whales and fish? — |

163 Progeny of Manks-cats without tails: some long and some short, therefore like dogs.

¹ Charles Lyell. *Principles of Geology*, vol. 3, London 1833. Appendix I. M. Deshayes's Table of Shells, gives the number of species in each genus of selected living and Tertiary shells, in various localities.

² Leopold von Buch. *op. cit.* p. 148: "Un lieu se trouve-t-il isolé par des obstacles naturels, par des chaînes de montagnes qui établissent une séparation plus effective que des espaces considérables de mer interposés, on peut toujours s'attendre à y trouver des espèces de plantes entièrement nouvelles, et ne croissant pas dans les autres parties de l'île. Un hasard favorable a peut-être porté, par un enchaînement particulier de circonstances, des semences pardessus les montagnes. Abandonnée à elle-même, la variété qui résulte des nouvelles conditions auxquelles elle est soumise, y formera, avec le cours du temps, une espèce distincte, qui s'éloigne d'autant plus de sa forme primitive, qu'elle reste plus longtemps dans cette région isolée, exempte d'autres influences."

³ Richard Owen. Probably personal communication.

⁴ John Hunter. *Observations on certain parts of the Animal Oeconomy*, London 1837, with notes by Richard Owen. P. 26 ["I should imagine," he writes, "that monsters were formed monsters from their very first formation, for this reason, that all supernumerary parts are joined to their similar parts, as a head to a head &c. &c."]

⁵ Thomas Campbell Eyton. "Notice of some Osteological Peculiarities in different skeletons of the Genus *Sus*", *Proc. Zool. Soc. Lond.*, 1837, pt. V, p. 23.

⁶ George Robert Waterhouse. Probably personal communication.

Ogleby¹ says: Wolves at Hudson bay breed with dogs, — the bitches never being killed by them, whilst they eat up the dogs. —

L'Institut. Curious paper by M. Serres² on Molluscous animals representing foetuses of Vertebrata etc. 1837, p. 370. Owen³ says nonsense. |

164 The distribut[ion] of big animals in East Indian Archipelago, very good in connection with Von Buch Volcanic chart and my idea of double line of intersection. —

At India House collection of Birds from Java. — At Leyden series from several islands. — Bear peculiar to Sumatra and not found on Java. — Monkey peculiar to latter, not to former. — Dr Horsfield.⁴ |

165-166 excised.

167 ? Consult Dr. Smith⁵ History of S. African cattle.

Phillips Geology,⁶ p. 81, in Lardners Encyclop. Proportion between fossils and recent shells, between herbivorous and zoophagous mollusca according to periods. —

NB. Was Europe desert (like S. Africa) after Coal Period? |

168 ? In those divisions of mollusca, where species now least in number (as cephalopods), in last tertiary epoch most genera dead? — Examine into this in Phillips.⁷ — According to this formerly there would have been many genera of monotrematous animals. — p. 82. There are many tables in Phillips of numerous genera in fossil and recent state well worth consideration. — |

169 Tabulate Mammalia on this principle.

Man in *savage* state may be called species, in *domesticated* races. — If all men were dead, then monkeys make men. — Man makes angels. — |

170 Those species which have long remained are those — ? Lyell⁸? — which have wide range and therefore cross and keep similar. But this is difficulty: this immutability of some species.

In Phillips,⁹ p. 90, it seems the most organized fishes lived far back, first approaching to reptiles at Silurian age. — |

171 How long back have insects been known? As Gould¹⁰ remarked to me the "beauty of species is their exactness", but do not known varieties do the same, may you not breed ten thousand greyhounds and will they not be greyhounds? — Yarrell's¹¹

¹ William Ogilby? The reference has not been traced, but John Wandesford Ogilby was Assistant Secretary to the Hudson's Bay Company from 1777 to 1780. At the London Office of the Company, Beaver House, there is a MS by Andrew Graham who was on the staff from 1750-1775: "Observations on Hudson's Bay", in which the following passage occurs: "a she-wolf copulated with a husky dog . . ."

² Antoine-Etienne-Renaud-Augustin Serres. "Anatomie des mollusques", *L'Institut*, Paris 5, 1837, 221, p. 370.

³ Richard Owen. Probably personal communication.

⁴ Thomas Horsfield. *Zoological researches in Java and the neighbouring islands*, London 1824. *Semnopithecus pyrrhus* = *Presbytis cristatus*, Java. *Ursus malayanus* = *Helarctos m.*, Sumatra.

⁵ Andrew Smith. Cf. *Variation of Animals and Plants under Domestication*, vol. 1, p. 88: "Sir Andrew Smith several years ago remarked to me that the cattle possessed by the different tribes of Caffres, though living near each other under the same latitude and in the same kind of country, yet differed, and he expressed much surprise at the fact."

⁶ John Phillips. *Treatise on Geology*. *Lardner's Cabinet Cyclopaedia*, London 1837.

⁷ John Phillips. *A Treatise on Geology*. *Lardner's Cabinet Cyclopaedia*, London 1837, p. 83: "Most of the fossil cephalopoda belong to extinct genera."

⁸ Charles Lyell. No reference to this subject in Lyell's published works has been traced.

⁹ John Phillips. *A Treatise on Geology*. *Lardner's Cabinet Cyclopaedia*, London 1837, p. 90. Fishes with placoid and ganoid scales are shown dating back to the Silurian.

¹⁰ John Gould. Probably personal communication.

¹¹ William Yarrell. Probably personal communication.

remark about old varieties affecting the cross must [be] well worthy of observation.— |

172 I think it is certain strata could not now accumulate without seal-bones and cetaceans, — both found in every sea from Equatorial to extreme poles. —

Oh, Wealden, — Wealden. —¹

Do the N. American Tertiary deposits present analogies to shells of living seas? |

173-174 excised.

175 A breed of Blood-Hounds from Aston Hall close to Birmingham, and supposed to be descended from a breed known to be there since the time of Charles, — and now in the possession of Mr Howard Galton have one of the vertebra, about $\frac{2}{3}$ from base of tail, enlarged here [?] | very considerably, so that any person would say the tail was broken and this came so often that it was difficult to obtain a litter without this defect. Very curious case. — W. D. Fox.²

When dogs are bred into each other, the females loose [lose] desire, and it is required to give the cantharides. |

177-178 excised.

179 Bull. Soc. Geolog., 1834, p. 217. Java Fossils: 10 out of twenty have analogues in the Indian sea. — Deshayes.³

Mr M'Clay⁴ is inclined to think that offspring of Negro and white will return to native stock (the cross often whiter than white parent); the mulattos themselves explain it by intermarriage with people either a little nearer black | or white as it may happen. — Dr Smith⁵ says he is sure of the case at Cape. — M'Clay argues from it Black and White species. — For, says he, seeds of hybrid lillies etc. etc. (V[ide] Herbert⁶ on hybrids) thus act. — Now the point will be to find whether know[n] varieties in plants do so, — as in cacti etc. etc., — as in dogs; investigate 181 case of pigeons, fowls, rabbits, | cats etc. etc. — When black and white men cross, some offspring black, others white, which is more closely allied to case of cross of dogs. — See Paper in Philosophic Transactions on a quagga and mare, crossing by Lord Moreton [Morton],⁷ where mare was influenced in this cross to after births like aphides. — Case of boy with foetus developed in breast, — looking as if many ova 182 impreg- | nated at once. — Dr Smith⁸ considers the Caffers (like Englishmen) men of many countenances, as hybrid race. Is not this contradiction to his view of races

¹ Darwin's exclamation probably refers to the problem presented by the apparently estuarine nature of the Wealden deposits and the embedding of freshwater species in them. (Cf. Lyell, *Principles of Geology*, vol. 1, London 1830, p. 134; vol. 2, London 1832, p. 275; vol. 3, London 1833, p. 325). Information kindly supplied by Mr. S. C. A. Holmes of the Geological Survey.

² William Darwin Fox. Probably personal communication. (Cf. *Variation in Animals and Plants*, 1868, vol. 2, p. 121.)

³ Gérard Paul Deshayes. *Bull. Soc. Geol. France*, vol. 4, Paris [1834], p. 217: "M. Deshayes fait connaître à la Société que M. Hardie lui ayant fait voir les fossiles qu'il a recueillis dans l'Inde, à l'île de Java, dans un terrain tertiaire très moderne, il a reconnu que, parmi les vingt espèces environ qui lui ont été communiquées, dix sont rigoureusement déterminables, et ont certainement leurs analogues dans les mers de l'Inde."

⁴ William Sharp MacLeay. Probably personal communications.

⁵ Andrew Smith. Probably personal communication.

⁶ William Herbert. *Amaryllidaceae: preceded by an attempt to arrange the Monocotyledonous orders, and followed by a Treatise on cross-bred vegetables and Supplement*. London 1837.

⁷ George, Earl of Morton. "A singular fact of natural history. Peculiarities of the progeny of an Arab horse from a mare that had previously bred with a Quagga." *Phil. Trans. Roy. Soc.*, 1821, p. 20.

⁸ Andrew Smith. Probably personal communication.

not mingling? — In Fox's¹ case of Blood Hounds — a little mingling would probably have been good, namely such as Blood Hounds from other parts of England. |

- 183 Mr Bell² of Oxford Street had a very fine blood hound bitch which would never take the dog. But at last a rough-haired shepherd dog lined her and produced a very large litter — never afterwards went in heat. This is good instance of same fact in Mr Galton's case. — It explain[s] the loss and experience (must probably have occurred to every one) of rare breeds of dogs from owners great care of them. Fox says when two dogs of opposite breeds are crossed, sometimes offspring quite inter-
184 mediate | sometimes take strongly after either parent, about as often one way as other. — He has known case of good pointer and rough water spaniel produce litter like both parents, and Mr Bell has half blood-hound and greyhound. —

When two dogs have lined bitch directly one after the other, puppies differ, and [are] like both parents. — Fox told me of case of mare covered by blood horse and carthorse two folds [foals ?] . . . |

185-190 excised.

- 191 Mr Herbert's³ papers are in the Horticultural Transactions and a distinct work on Hybridity under title of Amaryllidae and Narcissus. Mr Donn [Don] considers Mr H[erbert] rather wild.

Mr Donn⁴ [Don] remarks to me that give him a species from Ireland, England, Scotland and other localities, and each one will have a peculiar constant aspect. That is varieties, though of trifling order are formed by nature. |

- 192 Carmichael,⁵ Tristan D'A Cunha, a list of its Flora is given. Mr Don⁶ remarked to me, that some good African and some good S. American forms (and on average some of these forms would have some peculiarity). — Now when we hear that the whole island is volcanic, surmounted by crater and studded with others, we see a beginning to island. Graham Island. — We know many seeds might be transported
193 some blown — floating trees. | — Thrushes (*Turdus Jagonensis*?) and bunting[s] (*Emberiza Brasiliensis*?) and coots (*Fulica chloropus*) might bring in stomach etc. etc. (Mem.: discover what kinds of seed these plants). (Mem.: Fact stated by Mr Don⁷ in island[s]. Teneriffe, St. Helena, J. Fernandez, Galapagos. Many trees [and] compositae, because seeds first arrived and hence formed trees; Ferns ditto), and would creator *make* plants when this volcanic point appeared in the great ocean,
194 have made | plants of American and African form, merely because intermediate

¹ William Darwin Fox. Probably personal communication.

² J. Bell, "of Oxford Street". Bell, Thomas: *A History of British Quadrupeds*, London 1837, p. 209: "The race [of blood-hounds] has been gradually diminishing, and is now very rarely to be met with in its purity. Amongst the very few instances of its present existence, I may mention a fine breed in the possession of Mr. J. Bell, of Oxford Street, who retains them in great purity." Darwin's information was no doubt transmitted personally by Mr. J. Bell.

³ William Herbert. "Instructions for the treatment of the *Amaryllis longifolia*, with some observations on the production of hybrid plants." *Trans. Hort. Soc.*, vol. 3, 1820, pp. 187-196: and "On the production of hybrid vegetables, with the result of many experiments made in the investigation of that subject", *Trans. Hort. Soc.*, vol. 4, 1822, p. 15.

⁴ George Don (junior). Probably personal communication.

⁵ Captain Dugald Carmichael. "Some account of the Island of Tristan da Cunha and of its natural productions", *Trans. Linn. Soc. Lond.*, 12, Part II, 1818, p. 483.

⁶ George Don (junior). Probably personal communication.

⁷ George Don. Presumably personal communication or perusal of Don's manuscript Journal in Royal Horticultural Society of London (cf. A. W. Exell: *Catalogue of the Vascular plants of S. Tomé*, London B.M. (N.H.), 1944, p. 8.

position. — We cannot consider it as adaptation because volcanic islands whilst African sandstone and granite (that is genera near Cape), see if there are any species same as T. del Fuego and C. of Good Hope, show *possibility* of transport. If some cannot be explained more philosophical to state we do not know how transported. |
 195 (Glaciers might have acted at Tristan D'Acunha. — Carmichael,¹ Linn. Transacts., Vol. XII. —)

The alpine plants of the Alps must be new formations because snow formerly descended lower, therefore species of lower genera altered, or northern plants.

Mem. The antarctic flora must formerly have been separated by short space from mountains low down, therefore plants common ; take an example from T. del Fuego. |
 196 Ellis² (?) says Tahitian kings would hardly produce from incestuous intercourse, — a parallel fact to Blood Hounds.

Before attraction of gravity discovered it might have been said it was as great a difficulty to account for movement of all [planets] by one law,³ as to account for each separate one ; so to say that all mammalia were born from one stock, and since distributed by such means as we can recognize, may be thought to explain nothing, — it being as easy to produce for the creator two quadrupeds at S. America — jaguar and Tiger. |

197–202 *excised*.

203 When species cross and hybrid breed, their offspring show tendency to return to one parent ; this is only character, and yet we find this same tendency (only less strongly marked) between what are called varieties. NB. One mother bringing forth young having very different characters is attempt at returning to parent stock. I think we may look at it so — ?? It holds good even with trifling differences of expression — one child like father, another like mother. |

204 Has Lowe⁴ written any other paper besides one in Latin, one on Madeira — any general observation. Difference of species between land shells of Porto Santo and Madeira. I believe very curious.

My idea of propagation almost infers, what we call improvement. All mammalia from one stock, and now that one stock cannot be supposed to be most perfect
 205 (according to our ideas of perfection), but intermediate | in character. The same reasoning will allow of decrease in character (which perhaps is case with fish, as some of the most perfect kinds the shark. Lived in remotest epochs). — ? Lizards of secondary period in same predicament. It is another question whether whole scale of Zoology may not be perfecting by change of Mammalia for Reptiles which can
 206 only be adaptation to changing world. — I cannot for a | moment doubt but what cetacea and Phoea now replace Saurians of Secondary epoch : it is impossible to suppose such an accumulation at present day and not include Mammalian remains. The Father of all insects gives same argument as father of Mammalia, but here

¹ Captain Dugald Carmichael. See above p. 64.

² William Ellis. *Polynesian researches, during a residence of nearly eight years in the Society and Sandwich Islands*, London 1831.

³ This is the first appearance of the argument used by Darwin in the *Sketch* of 1842, p. 84 ; and the *Essay* of 1844, p. 250.

⁴ Richard Thomas Lowe. " Primitiae Faunae et Florae Maderae et Portus-Sancti ; sive Species quaedam novae vel hactenus minus rite cognitae animalium et plantarum in his insulis degentium breviter descriptae ", [1830] *Trans. Camb. Phil. Soc.*, vol. 4, 1833, p. 1.

improvement in system of articulation. ? Whether type of each order may not be supposed that form, which wandered least from ancestral form. If so are present
 207 typical | species most near in form to ancient ; in shells alone can this comparison be instituted. —

People often talk of the wonderful event of intellectual man appearing. The appearance of insects with other senses is more wonderful. — Its [the insect's] mind more different probably and introduction of man nothing compared to the first thinking
 208 being — although hard to draw line, | not so great as between perfect insects and forms low hard to tell whether articulate or intestinal, or even a mite. — A bee compared with cheese mite — with its wonderful instincts. The difference is that there is wide gap between man and next animals in mind more than in structure.

If the skeleton of a negro had been found, what would anatomists have said? — ? Where is Pentland's¹ account of . . . |

209-210 excised.

211 A. B. C. D. (A) crossing with (B), and (B) being crossed with (C) prevents offspring of A becoming a good species, well adapted to locality. But it is instead a stunted and diseased form of plant, adapted to A. B. C. D. Destroy plants B. C. D. and A will soon form good species!

The increased fertility of slightly different species and intermediate character of offsprings accounts for *uniformity* of species and we must confess, that we cannot
 212 tell, what is the amount | of difference which improves and checks it. — It does not bear any precise relation to structure. Mem.: Eyton's² hogs and dogs.

The passage in last page explains that between species from moderately distant countries there is no test but generation (but experience according to each group) whether good species, and hence the importance naturalists attach to geographical ranges of species. |

213 Definition of species : one that remains at large with constant characters, together with other beings of very near structure. — Hence species may be good ones and differ scarcely in any external character. For instance, two wrens, found to haunt two islands — one with one kind of herbage and one with other — might change organization of stomach and hence remain distinct. |

214 When country changes rapidly, we should expect most species. —

The difference [between] intellect of man and animals not so great as between living thing without thought (plants) and living thing with thought (animal).

∴ My theory very distinct from Lamarck's.³

Without *two* species will generate common kind, which is not probable, then
 215 monkeys will never produce man, but | both monkeys and man may produce other species. Man already has produced marked varieties and may someday produce something else, but not probable owing to mixture of races. — When all mixed

¹ Joseph Barclay Pentland. Probably "Description of fossil remains of some animals from the northeast border of Bengal", *Proc. Geol. Soc.*, vol. 1, 1834, p. 76.

² Thomas Campbell Eyton. "Some Remarks upon the Theory of Hybridity", *The Magazine of Natural History*, N.S., vol. 1, London 1837, p. 357.

³ Darwin's point appears to be that Lamarck placed a great distinction between the higher animals which possessed a "sentiment intérieur", and the lower animals which do not. (*Philosophie Zoologique*, Paris 1809, vol. 2, p. 256).

physical changes (? intellectual [faculty] being acquired alters case) other species or angels produced. |

- 216 Has the Creator since the Cambrian formation gone on creating animals with same general structure. — Miserable limited view. —

With respect to how species are [formed], Lamarck's¹ "willing" doctrine absurd (as equally are arguments against it² — namely how did otter live before being made

- 217 otter — why to be sure there were a thousand intermediate | forms. — Opponent will say : show them me. I will answer yes, if you will show me every step between bull Dog and greyhound). I should say the changes were effects of external causes, of which we are ignorant, as why millet seed turns a Bullfinch black, or iodine on glands of throat, or colour of plumage altered during passage of birds (where is this statement? — I remember L. Jenyns³ talking of it), or how to make Indian cow with hump or pig's foot with cloven hoof. |

- 218 Ask Entomologists whether they know of any case of *introduced* plant, which an insect has become attached to, that insect not being called omniphitophagous.

But it will be said there are latent insects [instincts], — as crows against man with gun, and Bustards etc. etc.!!!

An American and African form of plant being found in Tristan D'Acunha, may be said to deceive man, as likely as fossils in old rocks for same purpose! |

- 219 Can the wishing of the Parent produce any character in offspring? Does the mind produce any change in offspring? If so, adaptation of species by *generation* explained?

NB. Look over Bell⁴ on Quadrupeds for some facts about dogs etc. etc. — NB. Animals very remote — ass and horse — produce offspring exactly intermediate. — Reference to Pig and Dogs.

My theory will make me deny the creation of any new quadruped since days of Didelphis in Stonesfield ∴ all lands united (Falkland Fox, ice). Mauritius — what a difficulty, when elevated, subsidence near is only hope. — New Zealand, compare to Van Diemen's land, glorious fact of *absence* of quadrupeds. — East India Archipelago, very good on opposite tendency. — |

- 220 Study Ellis and Williams [William Ellis]⁵ Zoology of South Sea islands — any animals [mammals]? I believe — none. — Canary islands? Madeira? Tristan D'Acunha? Iceland?

The connection between Mauritius and Madagascar very good. — Fernando Po and Coast of Africa equally good. — Small islands off New Guinea — same fact, see Coquille's Voyage. — Galapagos mouse (?) — brought by canoes. — Ceylon and India. — Van Diemen's Land — Australia. — England and Europe. — It will be well worth while to study profoundly the origin and history of every terrestrial mammalia, especially moderately large ones. — |

¹ Jean Baptiste de Lamarck. See Introduction.

² Darwin means that arguments against the formation of species are absurd. The argument about the evolution of the otter through intermediate forms is developed in the *Essay* of 1844, p. 152.

³ Leonard Jenyns, afterwards Blomefield. Probably personal communication.

⁴ Thomas Bell. *A History of British Quadrupeds*, London 1837 ; pp. 194 to 251 are devoted to the breeds of dogs.

⁵ William Ellis. *Polynesian researches, during a residence of nearly eight years in the Society and Sandwich Islands*, London 1831.

- 221 In the Flora of Tierra del Fuego, like that of North Europe, many genera and few species.

The number of genera on islands and on Arctic shores evidently due to the chance of some ones of the different orders being able to survive or [to] chance having transported then to new station. — When the new island splits and grows larger, species are formed of those genera, and hence by same chance few representative species. This must happen and then enquire [enquiry] will explain representative system.

- Of these we see example in English and Irish Hare. — Galapagos shrews and when
222 big continent, many species belonging to its own genera. | Therefore if in small tract we have many species, we may insure mass continental or many large islands. — Hence this must have been condition of Paris basin land. — How is this with Fernando Po, with plants of St. Helena and Tristan D'Acunha? — resolves itself into question of proportion of species to genus.

- If on one island several species of same genus — subsided land. — Mauritius? Although the horse has perished from S. America, the jaguar has been left and Fox
223 and bear. — If I had not discovered | channel of communication by which great Edentata might have roamed to Europe and Pachydermata from Europe to America, how strange would presence of jaguar [have] been in S. America. —

West coast of Africa and East of America ought to present great contrast in forms ; India intermediate ; see how that is. — ? Are shell-boring Mollusca like Carnivorous mammalia in their wide range and in their duration of species. (? Are carnivorous mamm[alia] in Paris basin altered ? perhaps more like present carnivora than Pachydermata.) |

- 224 If my theory true, we get 1st a *horizontal* history of earth within recent times, and many curious points of speculation ; for having ascertained means of transport, we should then know whether former lands intervened. — 2^d) By character of any two ancient fauna, we may form some idea of connection of those two countries. Hence India, Mexico and Europe — one great sea. (Coral reefs ∴ shallow water at Melville island). 3^d) We know that structure of every organ in A.B.C., three species of one genus can pass into each other by steps we see ; but this cannot be predicated
225 of structures in two genera. Although D.E.F. follow close to | A.B.C., we cannot be sure that structure (C) could pass into (D). — We may foretell species, limits of good species being known. It explains the blending of two genera. — It explains typical structure. — Every species is due to adaptation hereditary structure ; Latter far chief element. ∴ Little service habits in classification or rather the fact they are *not* far the most serviceable. We may speculate on durability of succession from what we have seen in old world and in current changes which may happen. —

- It leads you to believe the world older than *geologists* think ; it agrees with exces-
226 sive inequality of numbers of species in divisions, — look at articulata!!? | It leads to [knowledge of] nature of physical change between one group of animals and a successive one. — It leads to knowledge what kinds of structure may pass into each other ; now on this view no one need look for intermediate structure, say in brain, between lowest mammal and reptile (or between extremities of any great divisions) ; thus a knowledge of possible changes is discovered, for speculating on future. |

227 ∴ Fish never become a man. — Does not require fresh creation. — If continent had sprung up round Galapagos on Pacific side, the Oolite order of things might have early been formed. —

With belief of transmutation and geographical grouping we are led to endeavour to discover *causes* of changes, — the manner of adaptation (wish of parents??), instinct and structure becomes full of speculation and line of observation. — View of generation being condensation, test of highest organization intelligible. — May
228 look to first germ, | led to comprehend true affinities. My theory would give zest to recent and fossil Comparative Anatomy; it would lead to study of instincts, heredity and mind heredity, whole [of] metaphysics. — It would lead to closest examination of hybridity, — to what circumstances favour crossing and what prevent it; and generation, causes of change in order to know what we have come from and to what we tend, this and direct examination of direct passages of structure in species might lead to laws of change, which would then be [the] main object of study,
229 to guide our speculations | with respect to past and future.

The grand question which every naturalist ought to have before him when dissecting a whale, or classifying a mite, a grampus or an insect is What are the Laws of Life?

When we have near genera far back as well as at present time, we might expect confusion of species. — Important. For instance, take *Voluta* and *Conus* (??), which now near together, were not both genera formerly abundant.

Seed of Ribston Pippin tree producing crab [apple] is the offspring of a male and female animal of one variety going back? Whether this going back may not be owing to cross from other trees???? |

230 Do the seeds of Ribston Pippin and Golden Pippin produce real crabs, and in each case similar or mere mongrels?

It really would be worth trying to isolate some plants under glass bells and see what offspring would come from these. Ask Henslow¹ for some plant, whose seeds go back again, not a monstrous plant, but any marked variety. — Strawberry produced by seeds?? — Universality of generation strongly shown by hybridity of ferns. — Hybridity showing connexion of two plants. |

231 Animals whom we have made our slaves we do not like to consider our equals. — Do not slave-holders wish to make the black have other mind? — Animals with affection, imitation, fear of death, pain, sorrow for the dead — respect.

We have no more reason to expect the father of mankind, than *Macrauchenia*, yet it may be found. — We must not compare chance of embedment in man in present state with what he is as former species. His arts would not then have taken him over whole world. — |

232 The soul by consent of all is superadded, animals not got it, not look forward. If we choose to let conjecture run wild, then animals — our fellow brethren in pain, disease, death, suffering and famine, our slaves in the most laborious works, our companions in our amusements, — they may partake from our origin in one common ancestor, we may be all netted together. —

Hermaphrodite animals couple: argument for true molluscs coupling. — |

233–234 *excised*.

¹ John Stevens Henslow.

- 235 Geograph. Journal, Vol. V, P. I, p. 67. Dr Coulter¹ on decrease of population in California [by the] cessation of female offspring : applicable to any animal.

Athenaeum, p. 154, 1838. Hybrid Ferns.²

- It may be argued against theory of changes that if so, in approaching desert country or ascending mountain you ought to have a gradation of species, now this
236 notoriously is | not the case. You have stunted species, but not such as would make species (except perhaps in some plants, and then a chain of steps as found in some mountains). — How is this explained by law of small differences producing more fertile offspring. — I^{ly} All variation of animal is either effect or adaptation, ∴ Animal best fitted to that country where change has taken place. Nature. . . . |

237-238 excised.

- 239 Any change suddenly acquired is with difficulty permanently transmitted. A plant will admit of a certain quantity of change at once, but afterwards will not alter. This need not apply to very slow changes without crossing. — Now a gradual change can only be traced geologically (and then monument imperfect) or horizontally, and then cross breeding presents perfect change. |

- 240 It is scarcely possible to get evidence of two races of plants run wild. — (For we know that such can take place without impregnating each other). For if they are different, then they will be called species, and these producing fertile hybrids will not destroy that evidence, as so many plants produce hybrids, or else whole fabric will be overturned. — Hence extreme difficulty, argument in circle. — Falkland Island case good one of animals not soon being subjected to change in Americas.

- 241 Perhaps merely gone back previous | to fresh change. —

Get a good many examples of animals and plants very close (take European birds Mr Gould's³ case of willow wren and other varying in wild state to show that we do not know what amount of difference prevents breeding, or as others would express it amount of varying in wild state. —

- When breaking up the primeval continent, — Indian Rhinoceros, Java and Sumatra ones all different. — Join Sumatra and Java together by elevations now in Pro-
242 gress, and you will have two | Tapirs existing in East Indian seas. Marsupial animals all show greater connexion in Quadrupeds, but *plants do not follow* by any means. — Ostriches. — Hippo[po]tamus only african. — American and African forms mingle in India and East Indian islands. — Monkeys different not travellers??

Royle's⁴ case of Himalayan plants. ? Migrating birds. He told me some story of crane from Holland!!! In stomach or in feathers — seeds. — |

- 243 Two inhabitants of the tropics (whether one fossil or not) are related by real relationship, as well as effect of similar temperature. — Now those of temperate

¹ Thomas Coulter. "Notes on Upper California", *Journ. Roy. Geogr. Soc.*, vol. 5, 1835, p. 59. On p. 67: "It is a very extraordinary fact that their [the Indians'] decrease is greatly hastened by the failure of female offspring, — or the much greater number of deaths amongst the females in early youth than in the males."

² Martin Martens. "On hybridity in ferns", (Paper read before Botanical Society on 16th February 1838). *The Athenaeum*, 1838, p. 154.

³ John Gould. *The Birds of Europe*, London 1837, vol. 2, (pages unnumbered). P. 131: "A little variation frequently occurs in the size of each of the birds".

⁴ John Forbes Royle. *Illustrations of the Botany and other Branches of the Natural History of the Himalayan Mountains*, London 1834-1835.

regions and tropics are only related by one connection — viz. descent. — Hence far greater discordance in latter. Hence change in form. — This probably explains crag and miocene. — The descendants left in cooling climate might change twice over, whereas those which migrate a little to the southward would merely be specifically different if so. — Now this is difficult to explain by creation or we must suppose a
 244 multitude of small creations. — | Will Dromedaries and Camels breed? — As man has not had time to form good species, so cannot the domesticated animals with him! —

Modern origin shown by only one species far more than by non-embedment of remains — ? agrees with non-blending of languages? —

Till man acquired reason, he would be [a] limited animal in range, and hence probability of starting from one point. — |

245 In the crag we see the process of change of those forms, which have succeeded in becoming habituated to colder climate, whilst others died out or moved towards equator, or some species might then have been wanderers. —

There ought to be fewer species in proportion to genera, than in present seas. All the species which survives any change may undergo indefinite change (making in their history an eocene, miocene and pliocene epoch), whilst others may die out or move southward.

246 ∴ Species must be compared | to neighbouring sea. — For change of species does not measure time but physical changes (We assume like weather on long average tolerably uniform). — Comparing fossils with whole world, would be like in a palaeologic table in comparison of temperature of two countries, finding a very hot day in one, oh we will take a day from the equator to add to the mean of the other. |

247 If the world had cooled by secular refrigeration in chief part instead of change from insular to extreme climate, Iceland and North of Europe would have possessed a most peculiar Flora. — As European forms have travelled towards Equator, so would the plants from extreme north, which according to all analogy would have been very unlike southern European ones, — “a variation played on secular refrigeration”. |

248 Experimentise on land shells in salt water and lizards ditto. — Ask Eyton¹ to procure me some. Get Hope² to give me an account of parasitic animals of beast varying in different climates.

Those will not object to my theory, those the philosophers who soar above the pride of the savage, they perceive the superiority of man over animals, without such resorts. |

249–250 excised.

251 Duméril³ great work on Reptiles. M. D says some reptiles same from Mauritius and Madagascar and C. of Good Hope. — His book probably worth studying. —

Wingless birds [of] S[outh] continents. Ostriches. Dodo. Apteryx. Penguin. —

¹ Thomas Campbell Eyton.

² Frederick William Hope.

³ André-Marie-Constant Duméril. *Erpétologie générale ou Histoire complète des Reptiles*. Paris 1836, p. 278: “Parmis ces cinq dernières espèces Africaines [de Platydictyles], une a pour patrie commune le Cap de Bonne Espérance, Madagascar et Maurice.”

Logger-headed Duck. — Large proportion of Water and small of land — or few quadrupeds. —

Study production of great Fresh Water lakes of North America. |

- 252 If Parasites different, whilst man and his domesticated quadrupeds are not so, greater facilities of change in the articulata, than in Vertebrata. But how does this agree with longevity of species in Molluscs!!!

When we talk of higher orders, we should always say intellectually higher. — But who with the face of the earth covered with the most beautiful savannahs and forests dare to say that intellectuality is only aim in this world. |

253-260 excised.

- 261 Of genera in all classes are not a few only cosmopolitan, and in genera peculiar to any one country do not species generally affect different stations; This would be strong argument for propagation of species. — Again is there not similarity even in quite distinct countries in same hemisphere more than in other. |

- 262 Are there any cases where domesticated animals separated and long interbred having great tendency to vary? Is not man thus circumstanced? Varieties of dogs in different countries a case in point. — All cases like Irish and English Hare bear upon this. — |

- 263 Why do Van Diemen's land people require so many imported animals? —

At what point of tree of life can orders like birds and animals [mammals] separate etc. etc.

Work out Quinary system according to three elements. |

- 264 How is Fauna of Van Diemen's land and Australia? |

265-271 blank.

- 272 Falconer's¹ remarks on influence of climates, situations etc. etc. 242 Hook.

Smellie,² Philos. of Zoolog. 842

Poor Tract Lyell.

White³ regular gradat. in man 1024.

Fleming's⁴ Philosophy of Zoolog.

Royle⁵ on Himalaya Plants. — |

- 273 Would it not be possible to work through all genera and see how many confined to certain countries. So on with families. — Ask Royle⁶ about Indian cattle with humps. — |

- 274 ? To be solved if horses sent to India and long bred in and no new ones introduced, would not change be superinduced. — Why is every one so anxious to cross animals from different quarters to prevent them taking peculiar character. Indian Bull? — |

- 275 Do species of any genus, as American or Indian genus inhabit different kind of localities? — if so, change.

¹ Hugh Falconer. "On the Aptitude of the Himalayan Range for the Culture of the Tea Plant", *J. Asiatic Society of Bengal*, Calcutta 1834, vol. 3, p. 178.

² William Smellie. *The Philosophy of Natural History*, Edinburgh & London 1790, 1799.

³ Charles White. *An account of the regular gradation in Man, and in different animals and vegetables*, London, 1799.

⁴ John Fleming. *The Philosophy of Zoology*, Edinburgh & London 1822.

⁵ John Forbes Royle. *Illustrations of the Botany and other Branches of the Natural History of the Himalayan Mountains*, London 1834-1835.

⁶ John Forbes Royle. Cf. *Illustrations of the Botany and other Branches of the Natural History of the Himalayan Mountains*, London 1839, p. lxxiv.

THE GRAND QUESTION : Are there races of plants run wild or nearly so, which do not intermix, — any cultivated plants produced by seed. — *Lychnis*. — *Flox*. — |

276 Read Swainson.¹ |

277 blank.

278 In production of varieties is it not per saltum —

Islands bordering continents — same type. Collect cases. — African islands. — How in Juan Fernandez ? Humming-Birds.

Types of former dogs. Character of Miocene Mammalia of Europe. |

279 Mem. Mr Bell's² case of *Sub-Himalayan* land emys decidedly an Indian form of Tortoise. — On other hand, freshwater tortoise from Germany³ (where Mr Murchison's⁴ fox was found) decidedly next species to some South American kinds. — |

280 Are the closest allied species always from distant countries, as Decandolle⁵ says? (no, he only says — sometimes). We might expect disseminated species to say a little, but such should not be general circumstance. — In insects, in England, surely it is not — intermediate genera we might expect. — |

281 Lindley⁶ Introduction.

Dict. Science Naturelle.⁷

Géographie Botanique. De Candolle.⁸ Geol. Soc.

Horae Entomologicae.⁹

Linn. Soc.

Geoffr. St. Hilaire Philosophy of Zoology.¹⁰ Waterhouse.

¹ William Swainson. *A Treatise on the Geography and Classification of Animals*. Lardner's Cabinet Cyclopaedia, London 1835.

² Thomas Bell. *Proc. Zool. Soc. Lond.*, Part II, 1834, p. 17. "Specimens and drawings were exhibited of a *freshwater Tortoise*, forming part of the collection of Mr. Bell, by whom it was described as a type of a new genus, for which he proposed the name of *Cyclemys*." "Mr. Bell regards the *Tortoise* which he has thus characterized as supplying a link in the connecting series of the *land* with the *freshwater* families which has hitherto been wanting. . . ."

³ Thomas Bell. "Zoological observations on a new Fossil Species of Chelydra, from Oeningen." [1832], *Trans. Geol. Soc.*, vol. 4, 1835, p. 379.

⁴ Roderick Impey Murchison. "On the fossil fox of Oeningen, with an account of the lacustrine deposit in which it was found," *Proc. Geol. Soc.* 1826-1833, vol. 1, p. 167; *Trans. Geol. Soc.*, vol. 3, 1835, p. 277.

⁵ Augustin-Pyramus de Candolle. *Essai élémentaire de géographie botanique*, Strasbourg, 1820.

⁶ John Lindley. *An Introduction to the Natural System of Botany*, London 1830.

⁷ *Dictionnaire des sciences naturelles, dans lequel on traite méthodiquement des différens Etres de la nature*, edited by F. Cuvier with a prospectus by Georges Cuvier, Paris & Strasbourg 1816-1830.

⁸ Augustin-Pyramus de Candolle. *Essai élémentaire de géographie botanique*, Strasbourg 1820.

⁹ William Sharp MacLeay. *Horae Entomologicae*, London 1819-1821.

¹⁰ Etienne Geoffroy-Saint-Hilaire. *Principes de philosophie zoologique*, Paris 1830.



PRINTED IN GREAT BRITAIN BY
ADLARD AND SON, LIMITED,
BARTHOLOMEW PRESS, DORKING

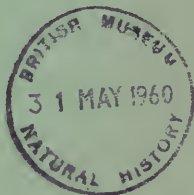
111.
A.
O.

DARWIN'S NOTEBOOKS ON TRANSMUTATION OF SPECIES

PART II

Edited with an Introduction and Notes by

SIR GAVIN DE BEER



BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
HISTORICAL SERIES Vol. 2 No. 3
LONDON : 1960

DARWIN'S NOTEBOOKS ON
TRANSMUTATION OF SPECIES
PART II. SECOND NOTEBOOK
(FEBRUARY to JULY 1838)

Edited with an Introduction and Notes

BY

SIR GAVIN DE BEER

Pp. 75—118



BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
HISTORICAL SERIES Vol. 2, No. 3
LONDON: 1960

THE BULLETIN OF THE BRITISH MUSEUM
(NATURAL HISTORY), *instituted in 1949, is
issued in five series corresponding to the Departments
of the Museum, and an Historical Series.*

*Parts will appear at irregular intervals as they
become ready. Volumes will contain about three or four
hundred pages, and will not necessarily be completed
within one calendar year.*

This paper is Vol. 2, No. 3 of the Historical series.

© Trustees of the British Museum, 1960

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued May, 1960

Price Fifteen Shillings

DARWIN'S NOTEBOOKS ON TRANSMUTATION OF SPECIES

Edited with an Introduction and Notes by

SIR GAVIN DE BEER

PART II. SECOND NOTEBOOK (FEBRUARY TO JULY 1838)

INTRODUCTION

IN his First Notebook on Transmutation of Species,¹ Darwin satisfied himself that it had occurred when populations were isolated and no longer able to prevent the variation that resulted from sexual reproduction and is normally kept in check by breeding throughout the population. In this way varieties become split off from species and eventually become species themselves, while old species become extinct, thereby increasing the separation between the surviving species, many of which after being split into daughter species become genera. This was what Darwin meant by "my theory", and it was already distinctively his even before he thought of natural selection because nobody before him had combined genetic variation, isolation, divergence, and extinction into a coherent theory of transmutation of species.

In his Second Notebook, which represents Darwin's train of thought from the beginning of February to the first half of July 1838, he was already concerned with the problem of expressing his views on paper and gave himself instructions for presenting his theory. He had even thought out how he would start: "The only cause of similarity in individuals we know of is relationship, children of one parent, races of animals—argue opening thus" (II 219)²; "The argument [that two varieties of old standing will not breed together] must thus be taken as in wild state" (II 30). In the event he started very differently as the *Sketch* of 1842 shows. Other instructions covered the different aspects of the argument: "Give specimen of arrangement" of species in relation to geographical distribution (II 45); Discrimination between species is empirical: "show this by instances" (II 70); "Mention persecution of early astronomers" (II 123); "Argue the case theoretically if animals did change excessively slowly whether geologists would not find fossils such as they are" (II 137); "Put note Sir W. Scott has written about" recalling images long past (II 172); John Gould's conviction that half-breed of Australian dog would be most like Australian "might be mentioned in note" (II 189). An especially awkward problem was the origin of instincts: "my theory must encounter all these difficulties" (II

¹ "Darwin's Notebooks on Transmutation of Species. Part 1, First Notebook." *Bull. Brit. Mus. (Nat. Hist.)*, Historical Series, vol. 2, pp. 23-73, 1960.

² References are given to the number of the Notebook and the manuscript page number.

199). Most important, he felt, was the following warning which shows that he was already alive to possible objections: "I fear great evil from vast opposition in opinion on all subjects of classification, I must work out hypothesis & compare it with results; if I acted otherwise my premises would be disputed" (II 202).

Among the claims which he was already able to make for "my theory" were the following: "My theory agrees with unequal distances between species" (II 145); "My theory explains that family likeness . . . holds good" (II 138); "My theory explains a grand apparent anomaly in nature" i.e. the existence of mules (II 135); "State broadly scarcely any novelty in my theory, only slight differences, the opinion of many people in conversation. The whole object of the book is its proof" (II 177).

One of the pillars of "my theory" was the principle of Community of descent and its consequences. "We now know what is the natural arrangement. It is the classification of relationship, latter word meaning descent." (II 155); "The one end of classification [is] to express relationship and by so doing discover the laws of change in organization" (II 158).

Darwin's recognition of the community of language of different species of birds in cries of distress (II 68) anticipated by 120 years the modern demonstration of the fact by electrical recordings¹.

Taxonomy acquired a completely new significance as a result of "my theory", and it is remarkable how Darwin's views anticipated modern conclusions. He recognized the principle that two similar but separated populations should not be regarded as distinct species until the regions between their ranges have been studied. Populations which overlap in their ranges but maintain their distinct characters can be regarded as good species (II 126). Therefore, a traveller "will not have brought home new species until he can show range and habits" (II 127).

For Darwin, species and genera had real existence in Nature. "Genus must be a true cleft putting out of case the analogy [of its species breeding with those of another genus]. If genus does not mean this it means nothing. There should be some term used where there is series" (II 129). This is Rensch's *Artenkreis*. As for the origin of genera, "Genus only natural from death or slow propagation of forms—just same way as men not all equally related to each other" (II 138); "The death of some forms & succession of others . . . is absolutely necessary to explain genus and species" (II 167).

Darwin soon saw that the onset of sterility was an essential factor in the origin of new species: "One species may have passed through a thousand changes, keeping distinct from other, and if a first and last individual were put together, they would not . . . breed together" (II 152). The geographical equivalent of this effect of passage of time is to be found in the British Herring Gull and Lesser Black-backed Gull. Darwin, however, had no evidence to support his view. Hence: "The most hypothetical part of my theory [is] that two varieties of many ages standing will not readily breed together" (II 30). This may be compared with T. H. Huxley's *caveat* that Darwin had not proved his point until he could show that natural selection had led to sterility between divergent products of evolution. Darwin realized this diffi-

¹ cf. "Developments in the study of animal communications" by P. Marler, in *Darwin's Biological Works*, edited by P. R. Bell, Cambridge 1959, pp. 150-206.

culty even before he had formulated his theory of natural selection. Meanwhile he investigated the possibility that the half-way stage to sterility is represented by sterile hybrid offspring (II 222), and concluded that "My views which would even lead to anticipate mules is very important for Lyell said to me the fact of existence of mules appeared to him most strange . . . my theory then explains a grand apparent anomaly in nature" (II 135).

The effects of "my theory" on the position of man was already realized: man "Likes to think his origin god-like" (II 155); "Not a deity" (II 77). Comparative pathology is invoked to good effect: "Many diseases in common between man and animals" (II 174).

Darwin's abhorrence of slavery is reflected in the following: "White man who has debased his nature by making slave of his fellow black" (II 154). Sexual selection is applied to man as well as to animals: "Cock birds attract female by song (analogy of man)" (II 178). Man is compared with the orang utan (II 79), and with other Primates: "A man grinning is to expose his canine teeth (this may be made a capital argument if man does move muscles for uncovering canines), no doubt a habit gained by formerly being a baboon with great canine teeth" (II 243); "Man in his arrogance thinks himself a great work worthy the interposition of a deity. More humble and I believe truer to consider him created from animals" (II 196).

The prevailing total ignorance of the causes of variation was a constant worry to Darwin. Always bearing adaptation in mind, he could only conclude: "Till we know uses of organs clearly, we cannot guess causes of change" (II 56). He was reduced to wrestling with William Yarrell's view that the oldest variety has the greatest effect on offspring in a cross (II 1), but was careful to remind himself to "give it" as Yarrell's theory. Later, (II 121) he gave it up. The difference between sports (or mutations) which were already recognized as inherited and minor variability which was so important for transmutation by imperceptible steps led Darwin to believe that there were "Two kinds of varieties. One approaching to nature of monster, [is] hereditary, [the] other [is] adaptation" (II 4).

Darwin already realized clearly that adaptation was a phenomenon of varying efficiency and that organisms could be imperfectly adapted to their environment (I 115, 130).

In one striking passage he anticipated the principle of the phenocopy: "If puppy born with thick coat [in temperate climate it is] a monstrosity, [but if the puppy is] brought into a cold country and [a thick coat] is then acquired, then [it is an] adaptation" (II 66). Admission of possible imperfection in Nature is shown in the following; "Even a deformity may be looked at as the best attempt of nature under very unfavoured conditions as an adaptation" (II 65). He realized that the phenomenon of the ptarmigan and hare becoming white in winter are not caused by the direct effect of the environment by physical action, but are instances of adaptation (II 84), and this example shows how closely variation and adaptation were associated in his mind. "The wonderful power of adaptation given to organization. This [is] really perhaps greatest difficulty to whole theory" (II 175). The recognition of adaptations often requires ingenuity, as in the following case: "Wax of ear bitter, perhaps to prevent insects lodging there" (II 174).

It was the fact of anomalies of geographical distribution that first brought Darwin up against the problem of transmutation. He soon saw that the distribution of large mammals was significant: "There is this great advantage in studying geograph: range of quadrupeds; that either created in each point, or migrated from those quarters where we know quadrupeds have existed for ages" (II 29). Geographical distribution introduced the possibility of isolation of groups on a grand scale: "Have the Edentata and Marsupials forms been chiefly preserved where shut up by themselves without other animals?" (II 36); "How came it animals not preserved in Central S. America and yet in Africa and India?" (II 132). Related representative species in different regions interested him greatly: "Buzzards in Patagonia and in Chile a good case of replacement" (II 56); "Once grant my theory and the examination of species from distant countries may give thread to conduct to laws of change of organization" (II 70).

Darwin realized that if species had not been separated and specially created, there must have been a mechanism of evolution. Before he hit upon the principle of natural selection his views on this problem could not be very precise, but the notion of competition appears in the following passage, albeit without defined penalties for the losers: "Once grant that species and genus may pass into each other, grant that one instinct to be acquired (if the medullary point in ovum has such organization as to force in one man the developement of a brain capable of producing more glowing imagining or more profound reasoning than other, if this be granted) and whole fabric [of special creation of species] totters and falls" (II 76). The penalties make their appearance in the following: "The constitution being hereditary and fixed certain physical changes [in the environment] at last become unfit [for the organism] the animal cannot change quick enough and perishes" (II 153). He also wondered "Whether species may not be made by a little more vigour being given to the chance offspring" (II 61). Isolation is part of the mechanism: "Nature conscious of the principle of incessant change in her offspring has invented all kinds of plan to insure sterility, but isolate your species [and] her plans are frustrated" (II 53).

It has not been explained how and why Darwin adopted a mechanistic viewpoint at a time when religious orthodoxy permeated science and philosophy, but there is no mistaking it in the following passages: "Why is thought being a secretion of brain, more wonderful than gravity a property of matter?" (II 166). He even referred to mental processes as "machinery": Animals "can reason but man has reasoning power in excess. Instead of definite instincts his is a replacement in mental machinery so analogous to what we see in bodily that it does not stagger me" (II 78). The following remark needs no comment: "Love of the deity effect of organization, oh, you materialist!" (II 166). All the more remarkable is it to find Darwin giving voice to a view which Malthus would have rejected as anathema: "Educate all classes, avoid the contamination of caste, improve the women (double influence) & mankind must improve" (II 220).

Although the Second Notebook on Transmutation of Species was started in the beginning of February 1838 and finished in July of the same year, Darwin added lists of books to be read and read at dates subsequent to July 1838. Among these books under the date 3 October, is listed Malthus on Population, which enables the

date when Darwin read that book "for amusement" to be determined with precision. The significance of this information will be pointed out in the Introduction to the Third Notebook on Transmutation of Species.

As in the other Notebooks, a number of pages (102) were cut out by Darwin in 1856 when he began to write the work of which the *Origin of Species* was an abstract.

Darwin's Second Notebook on Transmutation of Species, also known as Notebook "C", is Darwin MS 122 in the Cambridge University Library, to the authorities of which acknowledgement is warmly made for their unfailing assistance and courtesy.

I am also deeply obliged to Dr. Sydney Smith for his kind criticism and help.

CHARLES DARWIN'S SECOND NOTEBOOK ON TRANSMUTATION
OF SPECIES FEBRUARY-JULY 1838

Inside front cover

CHARLES DARWIN

written between (beginning of February & July 1838)

. . . two pigeons which cross & keep colour on wing. Effects of colour on parent. white room. How are varieties . . . ? Books about amount of difference when hybrids produced have any close species ever yet failed. About trades affecting form of man. Could you get racehorse from cart horse . . .

All good References selected Dec 13 1856. Also worked through April 23 1873. |

- 1 Mr Yarrell¹ give it as his theory tells me he had no doubt that oldest variety takes greatest effect on offspring. Thus presuming those varieties to be oldest which have long been known in any country, he states that Esquimaux dog when crossed with pointer produced offspring much nearer Esquimaux than Pointer. — He has no doubt that same thing would happen with Australian dog & any of our common
- 2 varieties. He has ditto doubt that | chestnut for many generations back was crossed with Bay mare, only by a few generations, that offspring would be chestnut. — On this principle I may add, that fact of half cross with parents, going back to either parent, is lucidly explained. — Mr. Yarrell states that if any odd pigeon crossed with common pigeon, offspring must be like latter, because oldest variety. — He
- 3 says of two varieties of | pigeon, although having skulls so different, that they would be called genera, yet retain marking of wings like the wild rock pigeon. — Fact analogous to Owen's² Phil. remark of Apteryx having feathers. — It is possible time being an element in the transmission of form may explain mule and pig being half way. Yet dogs sometimes like father, sometimes like mother. The fact of |
- 4 great monstrosities being produced, & handed down with ease, is analogous to what occurs in plants. — All these facts clearly point out two kinds of varieties. — One approaching to nature of monster, hereditary, other adaptation. — Mr. Yarrell says, that after breeding in pigeons with very much care that it requires the greatest difficulty to rear them, eggs hatched under other birds & brought up by hand. These facts all account for |

5-14 excised.

- 15 Birds of Australia. Many in common? species? with New Guinea. — Many kinds common to New Guinea & rest of isle in E. Indi: Arch: In New Zealand a Sturnus of American form, a Synallaxis? American? p. 159 & 160 162 list of some birds of Tingetabou & New Ireland.³ — Gould⁴ will hereafter know about birds of

¹ William Yarrell (1784-1856).

² Richard Owen. "On the anatomy of the Southern Apteryx." Communicated April 10, 1838, *Trans. Zool. Soc. Lond.*, vol. 2, 1841, p. 257. On p. 258:—"The Apteryx presents such a singular and seemingly anomalous compound of characters belonging to different orders of Birds, . . . It seems, as it were, to have borrowed its head from the Longirostral Grallae, its legs from the Gallinae, and its wings from the Struthious order. It is clothed with a plumage having the characteristic looseness of that of the terrestrial birds deprived of the power of flight . . ." Presumably Darwin heard Owen deliver this paper or discuss it beforehand.

³ Jean-René-Constantin Quoy, et Joseph-Paul Gaimard. *Voyage de découvertes de l'Astrolabe. Zoologie.* Paris 1830, p. 159:—"La Nouvelle-Irlande a plusieurs genres d'oiseaux qui lui sont communs avec la Nouvelle-Guinée dont elle est si voisine."

⁴ John Gould (1804-1881).

N. Zealand.¹ L'Institut 1838. A *Dipus* & other rongeur in Australia. — p. 67 ? American forms ? An Infusorian not extinct species.² good Résumé ditto p. 62 ??? |
 16 Age of *Deinotherium*.³ p. 23. Bull : Soc. Geolog. 1837-8 Tom. IX. M. D'Urville on the Distrib. of Ferns in South Sea⁴ (Indio Polynes : vegetation far East) Ann : des Sciences Semplémt. 1825.

Get Henslow⁵ to read over the pages from about 8 to 20 of Zoologie of Coquille's Voyage to see if Lesson's remarks⁶ on the Flora can be trusted. |

17-18 excised.

19 Coquille Voyage p. 25. Mais il n'y a pas jusqu'aux îles Macquarie et Campbell (52° S) qui n'aient également leurs espèces ; et certainement on eût été bien éloigné, il y a peu d'années, d'admettre que ces oiseaux eussent leurs représentants dans de si hautes latitudes''.⁷ — ? translate ?

All Australian forms have representative (& instances given) in East Ind. Arch. — Birds of New Zealand absolutely different. — *Philedon cincinnatus* not found in
 20 Australia only New Zealand — Norfolk Is^d & New Caledonia | peculiar species of cassicans (? cassicans Australian form ?) p. 27. Many fish of Taiti found at Isle of France :⁸ instance of wide range, when means of wide range says same remark with regard to shells. — But he says shells towards extremities of the continents peculiar to the different points. — Work this out. L. Jenyns⁹ about my fish New Zealand and New Holland fish very similar. —

N.B. Lesson method of generalizing without tables of references highly unphilosophical. |

21 Consult Voyage aux terres australes¹⁰ Chap XXXIX tom IV p. 223, 2d edit.

Consult Latreille Géographie¹¹ des Insectes in 8° p. 181 who says insects Indian like Plants.

¹ William Ogilby. *L'Institut*, tome 6, Paris 1838, p. 67. Zoologie : Rongeurs australasiens. "L'autre animal décrit par M. Ogilby, quoique n'appartenant pas à un nouveau genre, est également intéressant en ce qu'il jette quelque lumière sur les lois de la distribution géographique des animaux. C'est une vraie Gerboise (*Dipus*) des plaines centrales de la Nouvelle-Hollande."

² Christian Gottfried Ehrenberg. *L'Institut*, tome 6, 1838, p. 62. Paléontologie : Infusoires. "M. Ehrenberg lit une note sur les masses que forment les infusoires siliceuses."

³ Heinrich Georg Bronn. "Sur l'âge géologique des terrains tertiaires du bassin de Mayence," *Bull. Soc. Géol. France*, tome 9, 1838, p. 23 :—"MM. Klipstein et Kaup ont rapporté les couches contenant leur *Dinotherium* au calcaire grossier des environs de Paris."

⁴ J. D'Urville. "De la distribution des fougères sur la surface du globe terrestre." *Annales des Sciences naturelles*, tome 6, Paris 1825, p. 51.

⁵ John Stevens Henslow.

⁶ René-Primevère Lesson, et Prosper Garnot. *Voyage autour du Monde exécuté sur la Corvette La Coquille. Zoologie*. Paris 1826, tome 1, pp. 12-19 are concerned with the floras of Oceania.

⁷ René-Primevère Lesson, et Prosper Garnot. *Ibid.*, tome 1, p. 25.

⁸ René-Primevère Lesson, et Prosper Garnot. *Ibid.*, tome 1, p. 27 :—"nous avons retrouvé à l'Isle de France un grand nombre des poissons de Taïti."

⁹ Leonard Jenyns, afterwards Blomefield, author of the Section on Fish in *Zoology of H.M.S. Beagle* London 1842.

¹⁰ François Péron. *Voyage de découvertes aux terres australes*, seconde édition revue corrigée et augmentée par M. Louis de Freycinet, tome 4, Paris 1824, p. 223 :—"Une observation très remarquable tend à confirmer l'origine que j'attribue ici aux incrustations de la Nouvelle-Hollande ; c'est que de l'immense étendue de côtes dont je viens de parler, le seul point sur lequel nous n'ayons pu voir aucune de ces incrustations, le port du Roi-George, se distingue aussi de tous les autres par la nature presque exclusivement quarteuse de ses rivages."

¹¹ Pierre-André Latreille. *Mémoires sur divers sujets de l'histoire naturelle des insectes, de géographie ancienne et de chronologie*, Paris 1819, tome 4, p. 180 :—"Quoique l'entomologie de la Nouvelle-Hollande forme un type spécial, elle se compose néanmoins, en grand partie, d'espèces analogues à celles des Moluques et du sud-est des Indes."

It would be very important to show wide range of fish & shells in tropical seas it would demonstrate: not distance, makes species but barrier. It would make strong contrast with southern regions.—It would now represent what actually has is taking place with quadrupeds.

p. 118 wild pigs of Falklands generally "red of bricks" hair.¹ Very stiff.

p. 120 Coati roux common near Conception.² Some tatous !!!

p. 120 Most of the dogs of Payta belong to the hairless kind said to come originally from Africa.³ |

22 p. 122 *Mus decumanus* at Caroline Is^{ds} & a Roussette.⁴

p. 136 Isle of France. — the Tenecs [tenrecs] from Madagascar.

Monkey from Java.⁵ —

Hairs [hares] & deer. — Procured two makis alive from there. —

Mem. Waterhouse knows of some species which escaped there. —

p. 139. *Vespertilio bonariensis* (from Buenos Ayres) holds same relation with equator that *Vesp. lasiurus* does in North Hemisphere.⁶ — |

23-28 excised.

29 Rabbits introduced in 64 of very many colours, like the cattle which I say "are as variously coloured as a herd in England." — Black & grey varieties of rabbits thus handed down for nearly 70 years. Galapagos mouse not the same section with house mice. It is wonderful how it could have been transported? What section does the New Zealand Rat belong to. There is this great advantage in studying geograph. range of quadrupeds; that either created in each point, or migrated from those quarters where we know quadrupeds have existed for ages. — |

30 The most hypoth: part of my theory, that two varieties of many ages standing, will not readily breed together. The argument must thus be taken, as in wild state (where instinct not interfered with, or generative organs affected as with plants) no animals *very* different will breed together, so when two great (which can be shown probable) varieties may be made in wild state, there will be presumption that they would not breed together. — We see even in domesticated varieties a tendency to go back to oldest race, which evidently is tendency to same end as the law of hybridity, namely the |

¹ René-Primevère Lesson, et Prosper Garnot. *Voyage autour du Monde . . . Zoologie*, Paris 1826, tome 1, p. 118 :—"Les cochons se sont également propagés sur les îles Malouines, et principalement sur un îlot, qui est à l'entrée de la baie Française. Leur nourriture n'est ni succulente, ni même abondante: aussi leur chair maigre, quoique possédant un fumet agréable, n'a aucun rapport avec celle de nos cochons domestiques, et encore moins avec celle des sangliers. Leur poils d'une rudesse extrême sont généralement d'une couleur rouge de brique . . ."

² René-Primevère Lesson, et Prosper Garnot. *Ibid.*, tome 1, p. 120 :—"Nous ne vîmes guère que le coati roux, qu'on dit être commun aux alentours de Penco, quelques tatous et une sorte de chat . . ."

³ René-Primevère Lesson, et Prosper Garnot. *Ibid.*, tome 1, p. 120 :—"Nous observâmes que la plupart des chiens de Payta appartenaient à la race des chiens sans poil (*Canis aegyptius*), le chien turc de Buffon, qui est originaire d'Afrique, suivant les auteurs."

⁴ René-Primevère Lesson, et Prosper Garnot. *Ibid.*, tome 1, p. 122 :—"Notre séjour sur l'île d'Oualan nous a permis d'y remarquer que deux espèces qui y soient vraiment indigènes. L'une est la roussette Kéraudren. . . . Le surmulot commun (*Mus decumanus*, *Mamm. Desm.*, 773)"

⁵ René-Primevère Lesson, et Prosper Garnot. *Ibid.*, tome 1, p. 136 :—"les tenrecs. Ces derniers, venus de Madagascar, . . . tandis que le singe (*Macacus sinicus*, Des. 32), originaire de Java, occupe les sommets escarpés de la montagne du Pouce."

⁶ René-Primevère Lesson, et Prosper Garnot. *Ibid.*, tome 1, p. 139 :—"Ces vespertiliens vivent à une égale distance de l'équateur, dans les zones tempérées des deux hémisphères du continent américain."

31-32 excised.

33 animals unite, all the change that has been accumulated cannot be transmitted ; hence the tendency to revert to parent forms, & greater fertility of hybrid & parent stock, than between two hybrids. — As we see external influences first affect external [for]m, so will the internal parts be of longest [?]nt & therefore most permanent. Owe[n re]markable laws of Brains & manner of generation & primary divisions of insects.¹

2. Relation of external conditions, & of succession : the latter is most intimately connected with important structure, which are less obviously affected by external
34 circumstances. These therefore will be chiefly hereditary. — | If varieties produced by slow causes, without picking become more & more impressed in blood with time, then generation will only produce an offspring capable of producing such as itself. — Therefore two different varieties will produce hybrids but not varieties which are not deeply impressed on blood, will cross & produce fertile offspring. In first case it will either produce no offspring or such as not capable of producing again. |

35 The varieties of Cardoon are cases like those of Primrose & Cowslip run wild.

The two species of *Clenonga* case of replacing species. Dr Smith² will give me some capital information.

? Carnivora of New and Old wor[l]d do not form two sections, is this not connected with wide range of animals. Follow this out where species of same *genera* in
36 [...?] word have not species generally wide range? Mice. — | Waterhouse's remarkable fact³ of no forms peculiar to (to special districts ???) land north of 30°, may be connected with Mr Blyth's statement⁴ of birds of Europe & America which are of different forms being migratory, also with Temmincks fact⁵ of forms being within Tropics. — European birds at Japan connected with European forms⁶ on Himalaya ?? — This is very remarkable when we consider number of quadrupeds in Eocene period. Have the Edentata & Marsupials forms been chiefly preserved, where shut up by themselves without other animals? But they were not shut up! |

37 Extreme southern points of S. Hemisphere fully characterized of each continent. Try amongst European quadrupeds if Africa destroyed would not then some forms

¹ Richard Owen. The reference appears to be to Owen's Lectures. In the *Syllabus of an elementary course of lectures on comparative anatomy* by Richard Owen to be delivered at St. Bartholomew's Hospital during April and May 1835, in the analysis of Lectures IV and V, on page 5, appear the words :—" Changes effected in the nervous and other systems during the metamorphoses of insects."

² Andrew Smith, whom Darwin met in South Africa.

³ George Robert Waterhouse. *The Zoology of the Voyage of H.M.S. Beagle*, Part II. Mammalia by George Robert Waterhouse. London 1839, p. 19 :—, *Felis pajeros* :—" it extends northwards as far as latitude 30°." p. 88 :—" *Lagostomus trichodactylus* is not found north of 30°." Darwin's obscure note would appear to mean " no forms peculiar to South America."

⁴ Edward Blyth. The reference is presumably to " Further remarks on the affinities of the feathered race," *Mag. Nat. Hist. Lond.* vol. 9, 1836, p. 509 :—" Many years have now elapsed since the genius of Buffon suggested the capital proposition that there is no absolute specific identity between any organism of the Eastern and Western continents, with the exception of those which inhabit very far to the north."

⁵ Coenraad Jacob Temminck. Perhaps *Histoire naturelle générale des pigeons et des Gallinacés*, Paris 1813, tome 1, p. 6 :—" Il paroît que les Pigeons et les Gallinacés habitent de préférence les parages de la zone torride."

⁶ This question is prompted by Edward Blyth : " Further remarks on the Affinities of the feathered Race", *Mag. Nat. Hist. Lond.* 9, 1836, p. 510 :—" we have every grade of diversity, from the obviously distinct Japanese peafowl (*Pavo muticus*), to the mealy linnet, which, apparently, differs in no respect from that of Europe."

be peculiar to it, so on & so on. — Whatever destroyed great Pachyderms in S. America destroyed great Edentata or American form. — Is the Australian Dipus an American form? The climates having grown more extreme both in N. & S. America, is only common cause I can conceive of destruction of great animals in Europe & America. |

- 38 Some portion of the world (Africa) being left more equable (yet America pre-eminently equable) might have allowed fresh species to have been formed & spread to other Africa & East India Arch. — But where these great animals had not spread then such tribes as Marsupial & Edentates increased most. Certainly Africa approaches nearest to what is supposed to have been condition of former whole world. America must have been string of islands. — |

39-44 *excised*.

- 45 The systematic naturalists get clear indication of circumstances in Geography to help in distinguishing empirically what is species. — The collector is directed to study localities of isl^{ds}. — Immense importance of local faunas foundation of all our knowledge especially great continents.

Give specimen of arrangement.

Rhinoceros

3 species

Cape Town good species

Indian species so distinct that all analogy [?]

from each other

I do not know how different.

{ Sumatra }
{ Java } — ditto from India

Some doubt from want of knowledge of times analogy from three first will give one *almost* certain guide ∴ time required to separate isl^d very long. Increase of knowledge would probably tell more *certainly*. Get closer species. Foxes good case on account of varieties in N. America. Mice of America. |

- 46 America & Indian deer. — Africa not. — Africa camels?? Africa Bears?? *Plantigrade carnivora*?? — Compare rodents of two countries & monkeys. Fact of Elephant same species in Borneo Sumatra India Ceylon — perhaps show great persistency of character. Hence *Elephas primigenius* over so wide a range & *Mastodon angustidens*. — Ogleby¹ has facts to show that Australian dog introduced by savages into Australia. — What are they? Colonel Montagu² probably contains some facts about close species of Birds. |

47-50 *excised*.

¹ William Ogilby. "Notice of certain Australian Quadrupeds, belonging to the Order Rodentia", read December, 1837; *Trans. Linn. Soc. Lond.*, vol. 18, 1841, 121. On page 121:—"... I think, that there are strong grounds for believing that the *Dingo*, or native dog, ... is not an aboriginal inhabitant of the continent, but a subsequent importation, in all probability contemporary with the primitive settlement of the natives. ..."

² George Montagu. "Observations on some species of British Quadrupeds, Birds, and Fishes. *Trans. Linn. Soc. Lond.*, vol. 7, 1804, p. 274. On page 282:—"were it not for the strong chestnut colour the Kentish Plover is said to possess on the crown of the head, as described by Lewin, and since by Dr Latham in the Second Synopsis to the General Synopsis, we should not have hesitated in pronouncing these three birds to be only one species." Page 287:—"It is indeed remarkable that a bird bearing such strong marks as the Black-headed Gull, in all the changes, from the nestling to the adult plumage, should have ever been multiplied into so many species [i.e. "brown gull", and "brown turn".] ... of the several, remarkable changes incident to the black-headed Gull ... one of those mutations is the identical bird in question, the Brown Gull."

51 Instinct goes before structure (habits of ducklings & chickens young water ouzels) hence aversion to generation, before great difficulty in propagation. —

Feathers on Apteryx because we may suppose longest part of structure. — Shape of wings have altered many times, but all have had feathers, — if wing totally obliterated. — This may account for permanence in many trifling marks, — such as the bands on pigeons back. — According to this description of class is description |
52 of ancestor of all birds, & so for birds, we thus obtain an abstract idea of a bird, an animal with skeleton of such general forms. —

The hybridity of ferns bears on my doctrine of cross-generation.

The infertility of crosse & cross is method of nature to prevent the picking of
53 monstrosities as man does. — One is tempted to exclaim | that nature conscious of the principle of incessant change in her offspring has invented all kinds of plan to insure sterility, but isolate your species her plans are frustrated or rather a new principle is brought to bear.

If man created as now languages would surely have been homogeneous. —

There must be some sophism in Lyell's statement¹ that some species vary more than what makes species in other animals. — |

54 Forster on South Sea² will probably contain description of domesticated animals in those regions.

Species so far are not natural that they are *either* A.B.C.D.E *or* A.C.D.E.H. Very striking to see M. Bibron³ looking over reptiles he often had difficulty in distinguishing which were species (theory admirably) yet a glance would tell from which country. — I often disputed for a moment. — Galapagos, S. American genera. —
55 The circumstances of having | two sexes is the check to distribution of birds & animals.

Mrs. Strickland & Hamilton⁴ found tertiary formation amongst Grecian isles ?see if type continued? See to Babbage⁵ & Virlet.⁶ — Whewell⁷ thinks (p. 642) anniversary speech Feb. 1838 thinks gradation between man & animals small point in tracing history of man. — granted. — but if all other animals have been so formed,
56 then man may be a miracle, but induction leads to other view. — | Till we know uses of organs clearly, we cannot guess causes of change. — hump on back of cow!! &c. &c.

¹ Charles Lyell. *Principles of Geology*, vol. 2, London 1832, p. 25 :—" we have only to suppose that what is true of size, may also hold in regard to colour and many other attributes, and it will at once follow that the degree of possible discordance between varieties of the same species, may in certain cases exceed the utmost disparity which can even arise between two individuals of many distinct species."

² John Reinhold Forster. *Observations made during a Voyage round the World, on Physical Geography* &c. London 1778, refers only to hog, dog, and cock among the domestic animals.

³ Gabriel Bibron, author of "Reptiles"; *Voyage autour du Monde exécuté pendant 1836, et 1837 sur la Bonite*; *Zoologie*, tome 1, Paris 1841.

⁴ Hugh E. Strickland, & William John Hamilton. "An account of a Tertiary deposit near Lixouri, in the island of Cephalonia", *Proc. Geol. Soc. Lond.*, vol. 2, 1834, p. 545.

⁵ Charles Babbage. "Observations on the temple of Serapis at Pozzuoli, near Naples; with remarks on certain causes which may produce Geological Cycles of great Extent", *Proc. Geol. Soc. Lond.*, vol. 2, 1833, p. 72.

⁶ Pierre-Théodore Virlet d'Aoust. *Expédition scientifique de Morée*, Paris 1833-5.

⁷ William Whewell. "Address to the Geological Society, delivered at the Anniversary, on the 16th of February 1838, by the Rev. William Whewell, President of the Society." *Proc. Geol. Soc. Lond.*, vol. 2, 1838, p. 642. On page 642 :—"The gradation in form between man and other animals, a gradation which we all recognise, and which, therefore, need not startle us because it is presented under a new aspect, is but a slight and, as appears to me, unimportant feature, in looking at the great subject of man's origin."

D'Orbigny (p. 108) says¹ having observed *B. tricolor* in Patagonia then in Chile & lastly 12,000 feet above sea in Bolivia, he examined all species & found " beaucoup des mêmes oiseaux que nous avons déjà observés en Patagonie ou au moins des
57 espèces très-analogues, quand ce n'étaient | pas tout à fait les mêmes ". This good case of replacement under peculiar conditions — of nearly same kind country distant.

The circumstances of ground woodpeckers, — birds that cannot fly &c. &c. seem clearly to indicate those very changes which at first it might be doubted were possible, — it has been asked how did the otter live before it had its web-feet. All nature answers to the possibility. —

My views will explain no mammalia in secondary epochs & developement of lizards. |
58 As we have birds impressions in Red Sandstone great lizards in ditto. — Coniferous wood in Coal Measure. — highest fish in old Red Sandstone. — Nautili in [blank] it is useless to speculate not only about beginning of animal life generally, but even about great division. Our question is not how there come to be fishes & quadrupeds
59 but how there come to be many genera of fish &c. &c. at present day. — | It is *assumption* to say generation produces young ones capable of producing young ones like itself, but?whether great assumption? not solely producing like itself, not applicable to monster.—Are monstrosity hereditary??? Does not atavism relate to this law? —

Local varieties formed with extreme slowness even when isolation from general circumstances effecting the area equably. — |

60 Animals having wide range, by preventing adaptation owing to crossing with unseasoned people would cause destruction. — Simile man living in hot countries, if continually crossed with people from cold, children would not become adapted to climate. —

Descent, or true relationship, tends to keep the species to one form (but is modified). The relationship of analogy is a divellent power & tends to make forms remote antagonist powers. — Every animal in cold country has some analogy in hot gaudy
61 colours so all changes may be considered in this light. — | Hence relation of analogy may chiefly be looked for in the aberrant groups. — It is having walking fly catcher, woodpecker &c &c which causes the confusion in this system of nature. — Whether species may not be made by a little more vigour being given to the chance offspring who have any slight peculiarity of structure. hence seals take victorious seals, hence deer victorious deer, hence males armed & pugnacious all order ; cocks all war-like ; this wars against the resemblances relationship, the dissemblances analogy, in any class those points which are different from each other, & resemble some other class, analogy. See Abercrombie² p. 172 for definition of analogy.

Zoolog. Journal.³ Parrots in Macquarie is^{ld} vol. III p. 430 alluded to by Capt. King.

¹ Alcide Dessalines d'Orbigny. *Voyage dans l'Amérique méridionale* . . . 1826–33, tome 4, Paris 1835, p. 108 ; observations on *Buteo tricolor*.

² John Abercrombie. *Inquiries concerning the Intellectual Powers and the Investigation of Truth*, Edinburgh 1830, p. 171 :—" 2. Relations of resemblance and analogy . . . When there is a close agreement between two events or classes of events, it constitutes resemblance ; where there are points of difference, it is analogy. In the latter case, we then trace the degrees of analogy, depending upon the number of points in which the resemblance holds, and the number of points in which there is a difference."

³ Phillip Parker King. " On the Animals of the Straits of Magellan ", *Zool. Journ.* vol. 3, London 1828, p. 430 :—" Parrots as you are well aware are brought from Macquarrie Island . . . "

- 62 Ditto p. 434 Table of birds from Cuba. Vigors,¹ nothing of much interest. | All the discussion about affinity & how one order first becomes developed & then another — (according as parent types are present) must follow after there is proof of the non creation of animals. — Then argument may be, — subterranean lakes, hot spring &c &c inhabited therefore mud wood [would] be inhabited, then how is this
 63 effected by — for instance, fish being excessively abundant | & tempting the Jaguar to use its feet much in swimming, & every developement giving greater vigour to the parent tending so produce effect on offspring — but *whole* race of that species must take to that particular habitat. — All structures either direct effect of habit, or hereditary & combined effect of habit, — perhaps in process of change. — Are any men born with any peculiarity, or any race of plants. — Lamarck's willing absurd,² ∴ not applicable to plants. |
 64 Epidemics of South Sea wonderful case of extermination of species. — Epidemic amongst trees. Plane trees all died certain year. Extreme difficulty of *tracing* change of species to species although we see it effected tempts one to bring one back to distinct creations. — It is only be [by] recollecting that the ground woodpecker &c fresh water animals of great Lakes are American form that one is brought to admit the
 65 possibility | (any great change in species is reduced by atavism). Even a deformity may be looked at as the best attempt of nature under certain very unfavoured conditions, — as an adaptation, but adaptation during earliest existence ; if whole life then real adaptation. The case of hereditary disease is on the same principle that cut a sheeps tail off plenty of times & you will have no tail (example probably not true) — or again healthy parents have healthy children. The other case is change during life of parent & therefore being always necessary may be called adaptation. |
 66 With respect to my theory of generation, fact of armless parent not having armless child, shows that there is reference to more than offspring (like atavism) & shows my view of generation right? — If puppy born with thick coat monstrosity, if brought into cold country & then acquired then adaptation. — |
 67 No Common Vultures in Australia³!! Wilsons ornithology. vol. III p. 226. Wilsons Ornithology, D'Orbigny,⁴ Spix,⁵ &c might compare birds of N. America & South, — any how temperate regions, — crows in N. America. Study Bonapartes⁶ list.

In the Zoological Journal⁷ I read a curious account to show that *very* many birds of different kinds have been known to assist in feeding young cuckoos ; as if there was storge [strong urge], which could not be resisted, when hearing cry of hunger of

¹ Nicholas Aylward Vigors. "Sketches in Ornithology etc.," *Zool. Journ.*, vol. 3, London 1828, p. 434 : — "the following 45 species occur among the birds from Cuba . . ."

² Jean-Baptiste de Lamarck. See Introduction to First Notebook, p. 32.

³ Alexander Wilson. *American Ornithology*, vol. 3, London 1832, p. 226 :—"The Vultures are comparatively a limited race, and exist in every quarter of the world, New Holland excepted . . ."

⁴ Alcide Dessalines d'Orbigny. *Voyage dans l'Amérique méridionale* . . . tome 4, 3e partie, Paris 1839.

⁵ Johann Baptiste von Spix. *Travels in Brazil in 1817-20*, London 1824.

⁶ Charles-Lucien Bonaparte. *A Geographical and Comparative List of the Birds of Europe and North America*, London 1838.

⁷ John Blackwell. "Facts relating to the natural history of the Cuckoo", *Zoological Journal*, vol. 4, 1829, p. 294 :—"In the Gentleman's Magazine for April 1806 two instances are recorded of young cuckoo having been occasionally fed by large numbers of birds of the same species as their foster parents . . ."

- 68 little bird. In same way Wilson¹ | (p. 5) describes many kinds of birds uniting together in pursuit of Blue Jay, when birds hears cry of distress of other parents. — Shows community of language.

Desert country is as effectual as a cold one in checking beautiful colours of species. — Mem. St. Jago; solitary Halcyon bird of passage. — *M. coronata* of Latham, wrong. Mr. Yarrell says that some birds or animals are placed in white rooms to give tinge to
69 offspring. Darkness effect on human offspring. — | White snow, — the fine green of vegetation, — ? account for colour of bird in district which they frequent!!? Wilsons' *American ornithology*² a mine of valuable facts, regarding habits range & all kinds of information, instinct. Swainson's remarks in *Fauna Borealis*³ must be studied. There is capital talk of extent of all species. Accumulate instances of one family sending out structures into many genera, — like *Synallaxis* or Marsupial animals
70 of N. America. | Hence it is universally allowed that the discrimination of species is empirical. Show this by instances.

Once grant my theory & the examination of species from distant countries may give thread to conduct to laws of change of organization! The little turtle without its parent running to the water is a good instance of innate instinct, better than child sucking or even duckling & fowls.

When talking of races of man, — black men, black bull finches from linseed, — notably effects of climate on some antecedent race perhaps not one now existing. |

71-72 excised.

- 73 Study the wars of organic being. — The fact of guavas having overrun Tahiti, thistle Pampas show how nicely things adapted. — The aberrant varieties will be formed in any kingdom of nature where scheme not filled up (most false to say no passages; nature is full of them. — Wading birds partially webbed &c &c) — & in round of chances every family will have some aberrant groups, — but as for number five in each group absurd. — The mere fact of division of lesser & more power (2.
74 typical 3. subtypical) | where power arbitrary, leaves door open for Quinarians to deceive himself. — Give the case of *Apterix* split, depress & elevate & enlarge New Zealand, a division of nature of *Apterix*, many genera & species.

The believing that monkey would breed (if mankind destroyed) some intellectual being though not MAN, — is as difficult to understand as Lyells doctrine of slow movements⁴ &c &c. |

- 75 This multiplication of little means & bringing the mind to grapple with great effect produced is a most laborious & painful effort of the mind (although this may appear an absurd saying) & will never be conquered by anyone (if has any kind of prejudices) who just takes up & lays down the subject without long meditation. — His best chance is to have [pondered] profoundly over the enormous difficulty of

¹ Alexander Wilson. *American Ornithology*, London 1832, vol. 1, p. 5 :—"The cries of the distressed parent soon bring together a number of interested spectators, (for birds in such circumstances seem truly to sympathize with each other) and he [blue jay] is sometimes attacked with such spirit as to be under the necessity of making a speedy retreat."

² Alexander Wilson. *Ibid.*

³ William Swainson. *Fauna Boreali-Americana; or the Zoology of the Northern parts of British America*. Part II, the Birds, London 1831.

⁴ Charles Lyell. The reference is to the production of great effects as a result of slow action over great periods of time, which is the basis of the *Principles of Geology*.

reproduction of species & certainly of destruction ; then he will choose & firmly believe in his new faith of the lesser of the difficulties. |

- 76 Once grant that species and genus may pass into each other, — grant that one instinct to be acquired (if the medullary point in ovum has such organization as to force in one man the developement of a brain capable of producing more glowing imagining or more profound reasoning than other, if this be granted!!) & whole fabric totters & falls. — Look abroad, study gradation, study unity of type, study
77 geographical distribution, | study relation of fossil with recent. The fabric falls! But man — wonderful man “ *divino ore versum coelum attentior* ” is an exception. — He is mammalian, — his origin has not been indefinite. — he is not a deity, his end under present form will come, (or how dreadfully we are deceived) then he is no exception. — He possesses some of the same general instincts all & feelings as animals. They on other hand can reason — but man has reasoning powers in excess, instead
78 of | definite instincts — this is a replacement in mental machinery so analogous to what we see in bodily, that it does not stagger me. — What circumstances may have been necessary to have made man! Seclusion want &c & perhaps a train of animals of hundred generations of species to produce contingents proper. — Present monkeys
79 might not, — but probably would, — the world | now being fit, for such an animal — man, (rude uncivilized man) might not have lived when certain other animals were alive, which have perished. Let man visit Ourang-outang in domestication, hear expressive whine, see its intelligence when spoken [to], as if it understood every word said — see its affection to those it knows, — see its passion & rage, sulkiness & very extreme of despair ; let him look at savage, roasting his parent, naked, artless, not improving, yet improvable and then let him dare to boast of his proud preeminence. — Not
80 understanding language of Fuegian puts on par with monkeys. | Gould seems to think that many species when close come from different localities as my Funaire — some genus of yellow and brown breasted bird in Australia &c &c — but of course they might be blended, if archipelago turned into continent &c &c.

- There is beautiful gradation of forms in Australia leading on one side into shrikes & at the other into crows. Yet all forming, according to Gould,¹ good genus. |
81 Gould seems to doubt how far structure & habits go together. This must be profoundly considered. — Structure may be obliterating, whilst habits are changing, or structure may be obtaining, whilst habits slightly precede them — From this view habits must form most important element in considering to which tribes — structure
82 without corresponding habits clearly showing true affinity, for instance | tail of ground woodpecker, — but tail of some ducks aberrant from habit. —

Gould² I see quite recognizes habits in making out classification of birds.

- Birds vary much (more than shells) owing to variety of station inhabited by them.
83 Timor. Australian forms amongst birds | Java, not so much. — Peculiarities of structure as six-fingered people are sometimes hereditary — yet these not adaptations — they are counteracted by nature by crossing with other varieties, but accidental³ changes after

¹ John Gould. “ Characters of two new species of birds constituting a new genus, *Aplonis*.” *Proc. Zool. Soc. Lond.*, Part IV, 1836, p. 73 :—“ He stated them to approximate, in his opinion, in nearly an equal degree to the genera *Lanius*, *Turdus*, and *Lamprotornis*.”

² John Gould. The reference is to Gould's treatment of species in *The Birds of Europe*, London 1837.

³ This word crossed out in MS.

birth do not effect progeny. Many dogs in England must have been lopped off & sheep's tails cut yet there is no record of any effect. — New Hollanders have gone on boring their noses &c &c. This congenital changes show that grandson is determined,
 84 when child is, — | shows that generation implies more than mere child, but that child should produce like children. Lyell has story from Beck¹ about six fingered children hereditary.

With respect to question which is adaptation, — examine ptarmigan, hare becoming white in winter of Arctic countries few will say it is direct effect, according to
 85 Physical laws, as sulphuric acid disorganizes | wood, but adaptation. — Albino however is monster, yet albino may so far be considered as adaptation, as best attempt of nature colouring matter being absent. — Again dwarf plant on alpine district & dwarf plant from seed, one adaptation other monsters. —

The only way of judging whether structure is owing to habits or hereditary is to see
 86 whether a large family has it, & one member of that | family having it with very different habits. — Thus bill & nostril of Puffinuria I think we may clearly attribute to hereditary origin & not adaptation to its habits. — Few will dispute that it is possible to have structure without habits — after seeing beetle with wings beneath
 87 soldered wing-cases — yet these wings may be of some use. — Nature | is never extravagant though clearly not of the use to which wings are generally applied. — Therefore argument not destroyed even if their shrivelled wings could be shown to be of some use. If we only had Puffinuria Garnottii & no other species — as we have only Ornithorhync[h]us, then we should never know how much structure was connected with habits, & how much hereditary. The circumstance of aberrant groups being small it is truism, for if not so not aberrant. — |

88 Taenioptera rufiventris is instance of bird belonging to family with peculiar coloured plumage, where colours have changed in accordance to habits, — one is tempted to suppose from beholding the ground. — Why do beetles & birds become dull coloured in sterile countries. —

Gould insist much upon knowing to what type a bird belongs. — I conceive without knowing from which country many birds come it would be impossible to classify them. — I would |

89-98 excised.

99 element geographical distribution is. — ? Pelagic forms — similar birds?? —

We must always bear in mind proofs of most equable climate both in S. & N. Hemisphere just anterior to present. ? cause of destruction of great animals?

Show independency of shells to external features of *land* by seeing how many species common to Patagonia & Tierra del Fuego & forest. insert Parrots in Macquarrie Isd.² Coast very good. Study D'Orbigny³, & range in West Guyaquil & Peru. |

¹ Charles Lyell. The 5th edition of the *Principles of Geology* has three references to Dr J. Beck of Copenhagen, quoted for geological observations. The present reference appears to be to a personal communication to Lyell.

² Phillip Parker King. "On the Animals of the Straits of Magellan", *Zoological Journal*, vol. 3, London 1828, p. 430:—"Parrots as you are well aware are brought from the Macquarrie Island . . ."

³ Alcide Dessalines d'Orbigny. *Voyage dans l'Amérique méridionale*, Paris 1835.

100 Henslow¹ in talking of so many families on Keeling seemed to consider it owing to one of each being fitter for transport. ? may it not be explained by mere chance? — or [is] it like each great class of animals having its aquatic aerial &c type? — This of consequence because applicable to N. Hemisphere.

N.B. Examine Abrolhos Flora with this view. Tristan D'acunha. St. Helena &c &c Juan Fernandez. |

101-102 excised.

103 After reading "Carus on the Kingdoms of Nature, their life & affinity",² in Scientific Memoirs I can see that perfection may be talked of with respect to life generally. — When unity constantly develops multiplicity (his definition "constant manifestation of unity through multiplicity") this unity, — this distinctness of laws from rest of universe (which Carus considers big animal) become more developed in higher animals than in vegetables.

p. 243 radiate animals plants turned inside out,³ have portion of organ of generation!!! Mem. Agassiz (1 No. Annals of Nat. Hist.) *spiral* structure in Echinodermata.⁴ |

104 Agassiz says Infusoria are insecta⁵ —

G. R. Treviranus Biologie⁶ referred to as compilation of action of organic nature on inorganic.

It is very remarkable as shown by Carus⁷ how intermediate plants are between animal life & "inorganic life". animals only live on matter already organized. —

This paper might be worth consulting if any metaphysical speculations are entered on upon life. namely Carus. |

105-118 excised.

119 alone, but on all the general arguments —

Lamarck was the Hutton of Geology, he had few clear facts, but so bold & many such profound judgment that he foreseeing consequence was endowed with what may be called the prophetic spirit in science. The highest endowment of lofty genius.⁸

¹ John Stevens Henslow. Personal communication.

² Karl Gustav Carus. "On the Kingdoms of Nature, their Life and Affinities", *Scientific Memoirs selected from the Transactions of foreign Academies of Science and Learned Societies and from foreign Journals*, edited by Richard Taylor, vol. 1, 1837, p. 223.

³ Karl Gustav Carus. *Ibid.*, vol. 1, 1837, p. 243 :—"We may now see why in the Medusa, the Sea-Star, the Echinus, and other inferior kinds of animals, the aperture of the mouth is turned downwards and the alimentary duct upwards . . ."

⁴ Louis Agassiz. "Prodromus of a Monograph of the Radiata and Echinodermata", *Ann. Nat. Hist.* vol. 1, 1838, p. 30.

⁵ Louis Agassiz. Reference untraced.

⁶ Gottfried Reinhold Treviranus. *Biologie oder Philosophie der lebenden Natur für Naturforscher und Aerzte*, Göttingen, 1802-1822.

⁷ Karl Gustav Carus. "On the Kingdoms of Nature . . ." *Scientific Memoirs* edited by Richard Taylor, vol. 1, 1837, p. 234 :—"The animal stands in the same relation to the vegetable kingdom as organized bodies in general do to the unorganized. . . ."

⁸ This remarkable sentence lacks a word, for as it stands it makes no sense since no man but Hutton was the "Hutton of Geology". It seems that the sentence should read :—Lamarck was the French Hutton of Geology, referring to Lamarck's *Hydrogéologie, ou recherches sur l'influence générale des eaux sur la surface du globe terrestre, sur les causes de l'existence du bassin des mers, de son déplacement, de son transport successif sur les différents points de ce globe, enfin sur les changemens que les corps organisés vivant exercent sur la nature et l'état de cette surface*. Paris 1802. In this work Lamarck put forward the view that Nature had unlimited time at her disposal.

Using geographical distribution of animals, I use (new step in induction) as key-stone of ancient geography species tell of Physical relations in time, form & distribution tells of horizontal barriers — |

- 120 Mr. Yarrel — says¹ my view of varieties is exactly what I state, — or picking varieties unnatural circumstance.

L^d Orfords had breed of greyhounds fleetest in England lost courage at end of chase would not run up hill.² (Bull-dogs are used because they have no scent. J. M. Wynne.³) He took thorough bred bull-dog & crossed & recrossed till there was a dash of blood with whole form of greyhound, — picking out finest of each litter & crossing them with finest greyhounds. —

- 121 Sir J. Sebright⁴ first got⁵ point on hackles on Bantams by crossing with common *Polish cock* is that not old variety & then recrossing offspring till size diminished, but feathers continued by picking chicken of each brood. — These bantam feathers | at last got dusky, then took white Chinese Bantam crossed & got some yellow & others yellower & white varieties by picking the yellow ones & crossing with dark bantam produced old variety. —

The pigeons which have such different skulls, but same marks on wings are Blue Pouter & small Bald Heads Mr. Yarrell will mention in his work.⁶

I am sorry to find Mr. Yarrell's evidence about old varieties is reduced to scarcely anything, — almost all imagination — He says he recollects all half Bred cattle of L^d Darnleys were most like parent Brahmin bulls — Mr. Y. is inclined to think that the male communicates the *external* resemblances [more] than the female. |

- 122 The expression hybrid & fertile Hybrids may be used to varieties as well as species.

As formation of species gradual so may we suppose that something intermediate, between no offspring & ordinary offspring. — This gradation is infertile offspring without organs of generation? By profound study of local variation laws of change whether beak (as it appears to me) colour of plumage & laws which might probably be reduced. |

- 123 What the Frenchman did for *species* between England and France I will do with *forms*. —

- 124 Mention persecution of early Astronomers, — then add chief good of individual scientific men is to push their science a few years in advance only of their age, (differently from literary men,) must remember that if they *believe* & do not openly avow their belief they do as much to retard as those whose opinion they believe have endeavoured to advance cause of truth. | It is of the utmost importance to show that habits sometimes go before structure. — the only argument can be a bird practising imperfectly some habit, which the whole rest of other family practise with a peculiar structure, thus *Tyrannus sulphureus* if compelled solely to fish, structure would alter. —

It is a difficulty how a different number of vertebrae are produced when (& in all

¹ William Yarrell.

² cf. *Variation of Animals and Plants under Domestication*, vol. 1, London 1868, p. 68.

³ Wynne. Unidentified.

⁴ Sir John Sebright. cf. *Variation of Animals and Plants under Domestication*. vol. 2, London 1868, p. 197.

⁵ A small drawing at this place in MS.

⁶ William Yarrell. *A History of British Birds*, London 1837-43.

such structures) there cannot be gradation. See what Eytons young pigs¹ — if vertebra much lengthened or there may be tendency to divide which often enough |
 125 repeated would cause an unequal number of vertebrae —

? When two very close species inhabit same country are not habits different. (Mem. Gould's willow wren)² but when close species inhabit different countries habits similar ?law? probable — ∴ if habits & structure similar would have blended together. Mem. Mr Herbert's³ law, *habits determining fertility*. |

126 Scheme for abolishing specific names & giving subgenera true value — as in
Opetiorhynch[us] fuliginosus (a) Falklands
 (b) T. del Fuego differ from
 (c) Chiloe
 (d) Chile

rupestris — good species.

?*O. modulator* + *O. patagonicus*. till neutral ground ascertained call them varieties but two ostriches good species because interlock.

It is reverting to old plan but reason now assigned for doing so. There should be mark to every species only known by analogy genera of course distant analogy
 127 from every country & class tells us that. | Analogy to be guide in islands species, — each describer giving his test namely differ as much as those (naming them) which are found together. —

If two species come over to this country without range or habits ascertained, put them as (a) (b) until data be given.—This will aid in preventing the chaos, — will point out what to observe, — will aid us in physiology. tell traveller what to observe, — if he knows he has done least part, — that he will not have brought home new species until he can show range & habits. —

Take instance of most disputed shells such as *Cyrena*. |

128 This is reform which probably will be slow but must take place. — Such a classification would answer every purpose & would present many ideas of causes of change. — The mark of analogy would be empirical because as soon as two species were placed in different subgenera, then it would be useless, but the formation of subgenera is empirical & is judged solely by comparison with other genera in other families. — it will however be much surer, when false species banished by this
 129 test. — | Excepting where as Andrew Smith,⁴ Richardson⁵ & Vaillant,⁶ & D'Orbigny⁷ has travelled this will be most difficult.

Sub genera so far may be eliminated where every species of a section is confined to one continent & every species [of another section] to another. then those sections

¹ Thomas Campbell Eyton. "Notice of some osteological peculiarities in different skeletons of the Genus *Sus*," *Proc. Zool. Soc. Lond.*, vol. 5, 1837, p. 23.

² John Gould. *The Birds of Europe*, vol. 2, London 1837, pl. & p. 131. (unnumbered). Description of Willow-wren, Chiff-chaff, and Wood-wren, including the differences in their songs and habits.

³ The Rev. The Hon. William Herbert.

⁴ Andrew Smith. *Report of the Expedition for exploring central Africa from the Cape of Good Hope . . . 1834, under the superintendence of . . . A. Smith*, Cape Town, 1836.

⁵ Sir John Richardson. *Fauna Boreali-Americana; or the Zoology of the northern parts of British America*, London 1829-37.

⁶ François Levaillant. *Voyage . . . dans l'intérieur de l'Afrique, par le Cap de Bonne Esperance dans les années 1780-85*, Paris 1790.

⁷ Alcide Dessalines d'Orbigny. *Voyage dans l'Amérique méridionale*, Paris 1835-47.

& subgenera are analogical, because we do not know whether nearest species of each might not breed.¹ — Genus must be a *true cleft* putting out of case the analogys. — If genus does not mean this it means nothing. — There should be some term used, when there is series. |

- 130 Could I not give Catalogue of Mammalia arranged according to my own methods.

Dasyurus being found fossil in Australia, & only one tree species (Mitchell's² authority) in Australia & several in Van Diemen's land is most important as showing former connection of two continents and death of form in one. The caves are at a

- 131 height of more than 1000 ft. & many hundred miles | from the sea, associated with teeth of seals and dugong, therefore immense age since breccia accumulated. — Surely ask Owen to see whether species same, excessive improbability. Mem. in Clift³ list a rat said to have been found!! rodents old inhabitants most important!! like *Dipus* of present day??! Major Mitchell does not think that dog was found in Van Diemens land. —

V. 1st. Number of Geographical Journal to discover whether dog found at Swan River. |

- 132 The change in England from *Rhinoceros* elephants &c in the most modern period, compared to Faunas of these countries, greater than *Toxodon*, *Macrauchenia* &c compared to America — the wonder is that the European forms were able to escape to some more fitting country. if *Toxodon* had been found in Africa the wonder [would] have been same for S. America & Europe. — the difficulty is how came it animals not preserved in Central S. America & yet in Africa & India??? — & Indian Isl^{ds}.⁴ |

- 133 Sir J. Sebright pamphlet⁵ most important showing effects of peculiarities being long in blood. Fully supported by Mr. Wilkinson⁶, — milking hereditary, development of important organ (see mark on pages), — crosses of diff: breeds succeed, yet seems to grant that difficult & other go back to either parent. — thinks difficulty in crossing race — bad effects of incestuous intercourse. — excellent observations of sickly offspring being cut off so that not propagated by nature. — Whole art of making varieties may be inferred from facts stated. — |

- 134 Shows instinct (Sir J. Sebright admirable essay) hereditary journey wild ducks. — lose as well as gain instincts. Wild & tame rabbit good instance — instincts of many kinds in dogs as clearly applicable to formation of instincts in wild animals many species in one genus external circumstances in both cases effect it. — Sir J. Sebright excellent authority because written on dog. Barking — applies it to national character. — |

¹ This paragraph up to here is marked by a query in the margin.

² Sir Thomas Livingstone Mitchell. *Three expeditions into the interior of eastern Australia, with descriptions of the recently explored region of Australia Felix, and of the present colony of New South Wales*, London 1838, vol. 2, p. 363 (Owen's identification of fossil specimens of *Dasyurus lanianus*.) The caves and their contents were first reported by Major T. L. Mitchell: "An account of the limestone caves at Wellington Valley, and of the situation, near one of them, where fossil bones have been found." *Proc. Geol. Soc. Lond.*, vol. 1, 1831, p. 321.

³ William Clift. "On the succession of types of fossil mammals from Australian caves closely allied to living marsupials". *Edinb. New Phil. Journ.*, vol. 10 1831, p. 394. The source where Darwin found this reference was no doubt Charles Lyell's *Principles of Geology*, vol. 3, London 1833, p. 144.

⁴ The words "& Indian Isl^{ds}" added in pencil.

⁵ Sir John Sebright. *Observations upon the instinct of Animals*, London 1836.

⁶ J. Wilkinson. "Remarks addressed to Sir J. Sebright", London 1820.

135 N.B. If two species were excessively old they would not make hybrids, whereas two newer ones even if more different might do so, — is this true?? My views which would even lead to anticipate mules is very important for Lyell said to me the fact of existence of mules appeared to him most strange. — This even might be said — my theory thus explains a grand apparent anomaly in nature. —

Many animals not breeding at all in domestication throws great difficulty in way of ascertaining about hybrids, — & is very remarkable fact, show influence of mind. |

136 It is not difficult to see that it is less repugnant to nature to produce one offspring unlike itself, than to produce that capable of producing itself alike. — in one case it changes one, in other it changes thousands in futurity. — This is right way of viewing it. — Variety when long in blood gets stronger & stronger, so that though by great effort one unlike can be produced, yet to produce whole generation unlike would go against the tendency it tries to go back to grandfather, but if too unlike its own parent this impossible (Hence we might expect even if two mules bred or two certain varieties, they would go back to grandfather which is | true) & infertility is consequence. —

The simple expression of such a naturalist “splitting up his species & genera very finely” show how arbitrary & optional operation it is, — show how finely the series is graduated. —

Dr Beck¹ doubt of local varieties should be remembered. Therefore do not consider it as proved that they are varieties (though that would be best).

Argue the case theoretically if animals did change excessively slowly whether²
138 geologists would not find fossils such as they are. — | My theory explains that family likeness, which as in absolute human family is undescribable yet holds good, so does it in real classification. The relation of all cock birds in Gallinaceous having tendency to [. . ?] or peculiar tails, strange.

?? Genus only natural from death or slow propagation of forms — just same way as all men not all equally related to each other. I cannot help thinking good analogy might be traced between relationship of all men now living & the classification of animals. — talking of men as related in the third & fourth degree. — |

139 A species must be compared to family entirely separated from any degree; the tailor [tailer] in each branch would be analogous to each other &c &c. — v. p. 140.

I should think meaning of circular arrangement was only so far true as avoided linear arrangement the central twigs dying, affinities would be in broken circles — which in each group is quite fatal. — Relations of analogy being those last obtained less firmly fixed & therefore most subject to change, — may account for certain organs not being fixed in some genera which are most fixed in others. |

140 In analogy it is not the relation to bear to each other but to some external contingency. — Affinity is the sum of all the relations, analogy is the close relationship in some one. — Imagine the men to have greater powers of change yet, as external conditions over whole world similar & constitution of men originally similar, limits of change would be same. Yet each family might have its own character. — We

¹ Presumably Dr Henrich Henrichsen Beck of Copenhagen who is referred to three times in Lyell's *Principles of Geology*, 5th edition, London 1837, as an authority on shells.

² This word crossed out in MS.

here suppose these changes of adaptation greater than those hereditary ones which would elapse, during time such changes |

141-142 excised.

- 143 When one reads in Ehrenberg's Paper on Infusoria¹ on the enormous production — millions in few days — one doubt that one animal can really produce so great an effect. — the spirit of life must be every where ambient & merely determined to such points by the vital laws. — So that all characters originally may must have had the character of analogical. —

Gould says it is only in large groups where you have representations. — The aerial type in each family is relation to elements & not habits as shown by frigate Bird & flying Hawk. |

- 144 Gould² seemed to think, that widow bird replaced Birds of Paradise — if such fantastic sexual ornaments have so intimate a relation to two continents as to be called into existence in two continents our ignorance is indeed profound & such it appears. — Is there not some statement about diversity of form in aberrant circles — explained by such not having been long in blood? — |

- 145 My theory agrees with unequal distances between species some fine & some wide which is strange if creator had so created them. — People will argue & fortify their minds with such sentences as "oh turn a Buccinum into a Tiger" — but perhaps I feel the impossibility of this more than any one. — no turn the Zebra into the Quagga, let them be wild in same country with their own instinct (even though fertile³ hybrids produced when compelled to breed) & then all that I want is granted. —

For at Galapagos make ten species of Orpheus, one of which has very short legs & long tail, short much curved beak. Other very long beak with short [tail]; let them only have progeny with species & there will be two genera, — let short billed one be exaggerated & all rest destroyed, far remote genera will be produced. |

- 146 As we know from Ehrenberg⁴ there are fossil (see scientific Memoirs & L'Institut) that there are Tertiary fossil Infusoria of same forms with recent & we have nothing to do with CREATION. —

The end of formation of species & genera is probably to add to quantum of life possible with certain preexisting laws. — If only one kind of plants not so many. — |

147-148 excised.

- 149 Mr Blyth⁵ remark that a resemblance between some forms in birds is visible when young but not when old, — thus speckled form of young blackbird good remark if general. —

¹ Christian Gottfried Ehrenberg. "Recherches sur les Infusoires", *Annales des Sciences Naturelles*, seconde série, tome 1 *Zoologie*, Paris 1834, p. 207:—"La force réproductrice des animaux infusoires est plus développée que dans aucune autre classe d'êtres".

² John Gould. The widow bird, which is a weaver, inhabits South Africa while the Birds of Paradise inhabit Australia. Gould's opinion was probably a personal communication to Darwin.

³ This word crossed out in MS.

⁴ Christian Gottfried Ehrenberg. "Paléontologie: infusoires fossiles du tripoli d'Oran". *L'Institut*, tome 5, 1837, p. 330. "Remarks on the real occurrence of fossil Infusoria, and their extensive diffusion" *Scientific Memoirs*, vol. 1, 1837, p. 400.

⁵ Edward Blyth. "Further remarks on the affinities of the feathered race; and upon the nature of specific distinctions", *Mag. Nat. Hist. Lond.*, vol. 9, 1836, p. 505. On p. 507:—"The black bird has when young, a spotted breast; and, in fact, the characters of its nestling plumage alone forbid its alienation from the spotted thrushes. Where, indeed, can we trace the line of separation between Mérula and Philomèla even? . . ."

Where any structure is general in all species in group we may suppose it is oldest, & therefore least subject to variation, — & good for generic divisions Ought genus to be founded on such characters as do not vary in the species of it : where does such occur?

Now some such characters rule are used by naturalists in their test of value of character. Therefore value of organ vary in different group & not known in single ones — viz. Macleay letter¹ to Fleming² p. 32 “ where it (mode of generation) varies according to the species, it is manifestly of less importance as affording natural characters than among those groups, where it remains less subject to Variation ”. Macleay’s Rule is converse : value of character depends on non-variation & not on extension? these go together? |

150 Dr A. Smith³ know lots of instances of replacement of one species by another, supply place in each others economy. Dr S. showed that savages are not born with any capacity for observation of tracks &c &c. Dr S. has some remarkable crochets about instincts whenever instinct is mentioned some definition must be given.

It would not be difficult to arrange children of same parents in a circle, — hermaprodite & father & grandfather must be introduced & made young, father must be left out of case, that difference occurring. — |

151 It will be necessary to show hybridity from few forms, parents of all species not possible in some detail. the relation to islands close species on these isld &c will probably upset it. — The space which one branch of the tree of life occupied after its decay, will be occupied by the vigorous shoots from each branch no : because decay in that space is effect of unfavourable conditions (hence rise & depression of importance in each group & connection of even distant ones) the characters will be first those of analogy but will grow into affinity, but whether ever arrive at true
152 affinity doubtful. | A species is only fixed thing with reference to other living being. — One species may have passed through a thousand changes, keeping distinct from other, & if a first & last individual were put together, they would not according to all analogy breed together. — The bottom of the tree of life is utterly rotten & obliterated in the course of ages. —

As *species* is real thing with regard to contemporaries — fertility must settle it. — |
153 Changes in structure being necessarily excessively slow they become firmly embedded in the constitution, which other marked difference in the varieties made by of nature & man. —

The constitution being hereditary & fixed, certain physical changes at last become unfit, the animal cannot change quick enough & perishes. — Lyell has shown⁴ such Physical changes will be unequally rapid with respect to their effects.

The Ægyptian animals domesticated?? & therefore most especially under care of man, & external circumstances not variable. — |

¹ William Sharp Macleay. “ *A letter on the dying struggle of the Dichotomous system* ”, London 1830, p. 32.

² John Fleming, author of the *Philosophy of Zoology*, Edinburgh 1822.

³ Andrew Smith, author of : *Report of the Expedition for exploring central Africa, from the Cape of Good Hope . . . 1834, under the superintendence of . . . A. Smith*. Cape Town 1836.

⁴ Charles Lyell. *Principles of Geology*, vol. 2, London 1832, p. 158 : — “ Rate of the change of species cannot be uniform, however regular the action of the inorganic causes.”

- 154 Animals have voice so has man. Not *saltus* but *hiatus*; hence if sickness death, unequal life — stimulated by same passions, brought into the world same way, animals expression of countenance. They may convey much thus. Man has expression. — animals signals, (rabbit stamping ground), man signals. — animals understand the language. They know the cry of pain as well as we. —

- It is our arrogance, to raise on the same shelf to look at common ancestor scarcely conceivable in savages precludes [?] any but instinct [?] feeling. Has not the white man, who has debased his nature by making slave of his fellow Black, often wished to consider him as other animal. — it is the way of mankind & I believe those who
155 soar above such prejudices yet have | justly exalted nature of man. like to think his origin godlike, at least every nation has done so as yet. —

We now know what is the natural arrangement. It is the classification of relationship, latter word meaning descent. —

A tree is taken by Fleming¹ as emblem of *dichotomous* arrangement which is false.

- There is same difficulty in arranging animals in paper as drying plant, all brought
156 in one plane. | Fleming Quarterly review says² nat : fam : of willows contains many Linnaean genera. — How are the character which unite these of older standing that constant number of stamens in order or in next family?

In considering fossil animals, what relation in *classification* in books, ought they to hold. —

Birds having web-feet when we see scarcely any traces of passage a difficulty but after all a slight one.

It will be necessary from manner Fleming treats subject to put in alternative of man created by distinct miracle. |

- 157 Macleay letter³ to Dr. Fleming Philosophical Magazine & Annals 1830 (?) "if she has put man on the throne (*of reason*), she has also placed a series of animals on the steps that lead up to it" p. 20, between mammalia & fishes, one penguin, one tortoise, shows hiatus but not saltus. When Linnaeus⁴ put whale between cow & hawk a frolicsome saltus p. 29. hiatus & saltus not syn[onymous]. — Linn : Transact.⁵ vol. xiv. — p. 24. Lamarck bears to Cuvier that relation of theoretical astronomer to plain observer⁶. |

- 158 Macleay⁷ seems to limit Lamarck definition of relations to settling the relative importance of the organs *in same state* in different animals. These questions may be all disputable, but the one end of classification to express relationship & by so doing discover the laws of change in organization. But the classification must *chiefly* rest

¹ John Fleming. *The Philosophy of Zoology*, vol. 2, Part III, p. 136 contains Fleming's views on classification. The reference to a tree is probably taken from William Sharp Macleay: "*A letter on the dying struggle of the Dichotomous System*, (London 1830), p. 8: "Man in this system may be compared to the trunk of a tree, Dominies and D.D.s to the branches, and John Fleming to the bud or leaf on the spray".

² John Fleming. Reference untraced.

³ William Sharp Macleay. *A Letter on the dying struggle of the Dichotomous System*, London 1830, p. 20.

⁴ William Sharp Macleay. *Ibid.*, p. 29. The reference is to: Carolus Linnaeus: *Systema Naturae*, Holmiae 1758. The last entry among the mammals on page 77 is *Delphinus* in the group Cete, after which immediately come the birds the first of which on page 86 are the Accipitres, beginning with *Vultur*.

⁵ William Sharp Macleay. "Remarks on the identity of certain general laws which have been lately observed to regulate the natural Distribution of Insects and Fungi", *Trans. Linn. Soc. Lond.*, vol. 14, 1825, p. 46.

⁶ William Sharp Macleay. *A Letter on the dying struggle of the Dichotomous System*, London 1830, p. 24.

⁷ William Sharp Macleay. *Ibid.*

on these same organs — habits, range &c &c — and the value of those organs when changed in different animals, — whether variation in eye of vertebrate afford better character than variations in eye of mollusc.

Macleay rests his whole groundwork of analogy on its concurrence in parallel parts of his series, i.e. cannot be discovered till circles completed.¹ |

159-162 excised.

163 N.B. *Pyrrhoalauda* (bird of St. Jago) of brown colour lives on ground, colour of habitation must have some effect. — Maldonado as good forests for beautiful birds. —

Hereditary ambling horses (if not looked at as instinctive) then must be owing to hereditary power of muscles. — Then we SEE structure gained by habit.

Talent &c in man not hereditary because crossed with women with pretty faces.

When horse goes a round the minute gets into the road at right angles how pleased it is just like man, emotions very similar. — Geolog. Transact. vol. V Birds bones in
164 strata of Tilgate forest.² | Seeing common gull in garden at Zoolog. Soc. its pale ash grey back like a black bird washed, whilst tips of primaries black, by examining series I cannot doubt laws of change will be known. — It appeared to me that half [breed] between fowls & pheasants is most like pheasant. I think so because viz. $\frac{3}{4}$ bred (hence hybrids in this case have bred). White & common pheasants have crossed. — |

165 The attachment of dogs to man not altogether explained by F. Cuvier,³ — Mem. Hensleigh's⁴ objection. — it is more, he cuts the matter short by saying man cannot be companion but master. — Hereditary tameness as well as wildness — cf. Sir J. Sebright.⁵ — Love of man gained & hereditary, problem solved.

Habits become important element in classification because structure has tendency to follow it, or it may be hereditary & strictly point out affinities. conduct of Gould,⁶
166 remark of D'Orbigny⁷ point out importance of habits in classification. — | Thought (or desires more properly) being hereditary it is difficult to imagine it anything but structure of brain hereditary, analogy points out to this. — Love of the deity effect of organization, oh you materialist! — Read Barclay⁸ on organization!! Avitism⁹ in mental structure a disposition & avitism in corporeal structure are facts full of meaning. — Why is thought being a secretion of brain, more wonderful than gravity a property of matter? It is our arrogance, it our admiration of ourselves. — |

167 The idea of foetus being of one both sexes is strongly supported by wonderful fact of bees changing the sex by feeding. — no it is developing a hybrid female it is a wonderful relation going through all nature. — Makes hermaphroditism one step

¹ William Sharp Macleay. "Remarks on the identity of certain general laws which have been lately observed to regulat the natural Distribution of Insect and Fungi", *Trans. Linn. Soc. Lond.*, vol. 14 Part III, 1838, p. 46.

² Gideon Mantell. "On the Bones of Birds discovered in the Strata of Tilgate Forest in Sussex", (read 10 June 1835) *Trans. Geol. Soc. Lond.*, vol. 5, 1840, p. 175.

³ Frédéric Cuvier. "Essay on the domestication of mammiferous animals . . ." *Edinb. New Phil. Journ.*, vol. 4, April 1828, p. 297.

⁴ Hensleigh Wedgwood (1803-1891). Brother of Darwin's wife.

⁵ Sir John Sebright. *Observations upon the instincts of Animals*, London 1836.

⁶ John Gould. *The Birds of Europe*, London 1837.

⁷ Alcide Dessalines d'Orbigny. *Voyage dans l'Amérique méridionale*, tome 4, 3^e partie, Paris 1835.

⁸ John Barclay. *An Inquiry into the opinions, ancient and modern, concerning life and organization*, Edinburgh 1822.

⁹ Avitism means relating to ancestors.

in series — in plants we have a step between monoecious & dioecious plants in animals it may be difficult to imagine how sexes were separated. — in plants we have some flower monoecious and other dioecious. Some flower hermaphrodites and others not???

The death of some forms & succession of others (which is almost proved, elephant has left no descendant in Europe, *Toxodon* in S. America) is absolutely necessary to explain genera & classes. if extinct forms were all fathers of present, then there
 168 would be | perfect series or gradation. — It is easy to see if South America grew very much hotter, then Brazilian species would migrate southward being ready made, — and so destroy individuals, whereas in Falkland Is^d they would change & make new species. — Alpine species being destroyed at Falkland Is^d. — even at Falklands some probably would stand change better than others¹. — Mem. Lyell hypothesis of change in Sicily.² — Splendid Harmony these views — did Lamarck connect extermination of some forms with his views.³ — as genera are large probably only few of extinct |
 169 forms have generated species & of 100 extinct species the greater number probably have no descendants on earth. —

The more complicated the animal the more subject to variation, therefore sexes in two animals : — When sexes are united (which probably is first stage) the tendency to change cannot be great, otherwise it would be unlimited.

We absolutely know the tendency is greater in Mammalia than in shells? univalves or bivalves. — |

170 Any man No. VI Magazine of Zoology & Botany p. 566 wants to see absurdity of Quinary arrangement let him look at abstract of Swainson⁴ on classification. "Let anyone ever with a very superficial knowledge like myself of real affinities i.e. structure of the whole animal let him read Mr Swainson's on the Classification of animals & observe the character of the *demonstrations* offered of the singular views there offered, & he must be a zealous man in the cause if his faith not staggered." I confess no dissertation against these views could possibly have had & brought so much conviction to my mind. — |

171 Reflect much over my view of particular instinct being memory transmitted without consciousness, a most possible thing see man walking in sleep. — an action becomes habitual is probably first stage, & an habitual action implies want of consciousness & will & therefore may be called instinctive. — But why do some

¹ These eleven words on p. 169 of the MS. are marked to appear here.

² Charles Lyell. *Principles of Geology*. vol. 1, London 1830, Chapter VI in which Lyell proved by means of the fossil Mollusca of Sicily that the climate of the Northern Hemisphere had deteriorated.

³ Jean-Baptiste-Pierre-Antoine de Monet de Lamarck. *Philosophie Zoologique*, tome 1, Paris 1809, p. 77 :—"Or, si quantité de ces coquilles fossiles se montrent avec des différences qui ne nous permettent pas, d'après les opinions admises, de les regarder comme des analogues des espèces avoisinantes que nous connaissons, s'ensuit-il nécessairement que ces coquilles appartiennent à des espèces réellement perdues? Pourquoi, d'ailleurs, seraient-elles perdues, dès que l'homme n'a pu opérer leurs destruction? Ne serait-il pas possible au contraire, que les individus fossiles dont il s'agit appartinssent à des espèces encore existantes, mais qui ont changé depuis et ont donné lieu aux espèces actuellement vivantes que nous en trouvons voisines. Les considérations qui suivent et nos observations dans le cours de cet ouvrage rendront cette conclusion très-probable" (p. 93 of 1873 reprint). Lamarck therefore did not connect his views with "extermination of some forms."

⁴ William Swainson. Review and Critical Analysis. "1. On the Geography and Classification of Animals. By William Swainson. 2. Classification of Quadrupeds. By William Swainson". *Mag. Zool. Bot.*, vol. 1, 1837, p. 545. On p. 566 :—"We have no hesitation, however, in stating our conviction, that Mr. Swainson's theory, in regard to the analogies of this order, is the true one, . . ."

actions become hereditary & instinctive & not others. — We even see they must be done often to be habitual or of great importance to cause long memory, — structure is only gained slowly. Therefore it can only be those actions which *many* successive generations are impelled to do in same way. — The improvement of reason implies diversity & therefore would banish individual but general ones might yet be transmitted. — |

172 Memory springing up after long intervals of forgetfulness, — after sleep strong analogies with memory in offspring. or simply structure in brain people & senses recollecting things utterly forgotten — Some association in such cases recall the idea it is scarcely more wonderful that it should be remembered in next generation.

(N.B. What are those marvellous cases where you feel sure you have heard conversation before, is strong association recalling up image which had been past — so great an anomaly in structure of brain not probable), put note Sir W. Scott has written about it.¹ If we saw a child do some action which its father had done habitually we should exclaim it was instinct, even if savage taken & was given a great coat & this he put on & we afterwards could understand (language better instance) he had done this without reflection or consciousness of reasoning to tell back from front &c or use
173 of button holes it would | be instinctive. — My view of instinct explains its loss? if it explains its acquirement. — Analogy a bird can swim without being web footed yet with much practice & led on by circumstance it becomes web footed. Now man by effort of memory can remember how to swim after having once learnt, & if that was a regular contingency the brain would become web-footed & there would be no act of memory. — There is no correlation between individual objects as *Ichneumon* & caterpillar though our ignorance may make us think so, but only between laws.¹ |

174 Many diseases in common between man & animals. *Hydrophobia* &c *cowpox*, proof of common origin of man. — different contagious diseases, where habits of people nearly similar. Curious instance of differences in races of men. —

Wax of Ear, bitter perhaps to prevent insects lodging there. Now these exquisite adaptations can hardly be accounted for by my method of breeding, there must be some cor[r]elation, but the whole mechanism is so beautiful. The cor[r]elations are not, however, perfect, else one animal would not cause misery to other, — else smell of man would be disagreeable to mosquitoes. |

175 We never may be able to trace the steps by which the organization of the eye passed from simpler stages to more perfect preserving its relations. — the wonderful power of adaptation given to organization. — This really perhaps greatest difficulty to whole theory. —

There is breed of tailless cats, near Bath, *Lonsdale*² ditto says sheep could not live for some time at New York instance of the fine relation of adaptation of animals & the country they inhabit, — & the first one that bred one was diseased in its loins
176 & all were so afterwards (forgets authority). — | *Lonsdale* is ready to admit permanent small alterations in wild animals & thinks *Lyell* has overlooked argument

¹ This sentence in square brackets in MS.

² William Lonsdale was Curator of the Geological Society's collections. The information about tailless cats was probably a personal communication.

that domesticated animals change a little with external influence, & if those changes permanent so would the change in animal be permanent. — It will be easy to prove persistent varieties in wild animals, but how to show species. — I fear argument must rest upon analogy & absence of variates in a wild state — it may be said argument will explain very close species in isld near continent, must we resort to quite different
 177 origin when species rather further. — Once grant good species as | carrion crow & rook formed by descent or two of the willow wrens &c &c & analogy will necessarily explain the rest. —

Lonsdale says¹ he has seen in old Book last Bear in England killed in year 1000, reference to succession of types? different species; Horses &c.

State broadly scarcely any novelty in my theory, only slight differences, the opinion of many people in conversation. The whole object of the book is its proof, its limiting the allowing at same time true species & its adaption to classification &
 178 affinities its extension. — | Von Buch Travels p. 302 account of trees² ceasing to grow far N. become stunted, altered & low fertility — more sickness?? because offspring too unlike.?? Memoir of Charles D'Orbigny on Plastic Clay of Paris³ contains many genera of Pachydermata or & other mammals, otter, civet cat, rodents. — (Pachyderm in Portland stone of Alps!!!! No) p. 15 (Lyell's pamphlet).⁴

Is man more hairy than woman because ancestors so, or has he assumed that character, — female & young seem most like mean character the others assumed. — Daines Barrington⁵ says cock birds attract females by song do they by beauty, analogy of man if so war not |

179-188 excised.

189 p. 428 ouzel sometimes builds nest without dome⁶ vol. 9 Mag. Z. & B.

p. 431 Missel thrush lately increased in numbers over whole of England & Ireland.⁷ — Curious in so wild bird. —

Annals of Natural History Vol. I p. 185 case of tit lark placing withered grass over nest when often looked at.⁸ — This most puzzling whether instinct or reason??

¹ William Lonsdale. Personal communication. There is a tradition that the last British bear was killed in Scotland in 1057.

² Leopold von Buch. *Reise durch Norwegen und Lappland*, Zweiter Theil, 1810. The account of trees is on pages 295-302.

³ Charles d'Orbigny. "Existence d'un étage de calcaire marin particulier au-dessous du terrain tertiaire du bassin de Paris, et d'une assise, également nouvelle, dépendant de l'argile plastique; découverte d'ossements fossiles dans ce dernier étage." *Comptes Rendus Acad. Sci.*, Paris, tome 3, 1836, p. 228.

⁴ Charles Lyell; presumably the reference is to a reprint of "On the strata of the plastic clay formation exhibited in the cliffs between Christchurch Head, Hampshire, and Studland Bay, Dorsetshire." *Trans. Geol. Soc. Lond.*, vol. 2, 1829, p. 279.

⁵ The Hon. Daines Barrington. "Experiments and Observations on the singing of birds," *Phil. Trans. Roy. Soc.*, vol. 63, 1773, p. 243.

⁶ William Thompson. "Contributions to the natural history of Ireland. No. 4 On the Birds of the order Insectores. The Water Ouzel." *Mag. Zool. Bot.*, vol. 2, 1838, p. 427. On page 429:—"The first nest of this bird I remarked was placed in a hole in the clayey bank of a pond, where, owing to the shelter afforded, there was no occasion for the display of its domed architecture, and this was consequently dispensed with."

⁷ William Thompson. "Contributions to the natural history of Ireland, No. 4 On the Birds of the order Insectores. The Mistle-Thrush." *Mag. Zool. Bot.*, vol. 2, 1838, p. 427. On p. 431:—"Has of late years extended its locality in Ireland, as in other parts of the British Islands, and is now found throughout the country."

⁸ William Thompson. "Contributions to the natural history of Ireland. No. 6 On the Birds of the order Insectores." *Ann. Nat. Hist.*, vol. 1, 1838, p. 181. On p. 185:—"... he observed a quantity of withered grass laid regularly across the nest. . . ." This remark is however made in respect of the meadow pipit.

Gould says¹ he believes that he has seen half fox & dog & that it was most like fox. — He felt sure the half breed of Australian dogs would be most like Australian. — Curious this ready answer without any leading question. — This might be mentioned in note. — |

190 Try to trace from simplest reasoning in lower animals many times produced, a general tendency produced, such as man getting habitually into passion, becomes habitually passionate. — The key to the affections might perhaps thus be found — a person who is habitually kind to children increases general instinctive feeling. — |

191 There is great difficulty in making an alpine species from one in lower country during gradual elevation of isl^d. — We must imagine a considerable range of one species on a mountain side of which the central parts become occupied by a third best adapted kind. — Lower species would then revert to pristine form (which must have been altered by crossing with alpine form). Lower species afterwards would probably often be destroyed, — or regrafted with fresh arrivals &c &c. — Climate altering as island increases, — upper parts attracting all the moisture. |

192 Henslow thinks² if leaf of plant varies, all organs vary in plant. The variation in character of leaf of plant is remarkable what is analogous to it in animals? —

Babington says³ in most plants, even those on Guernsey & on West Coast of Ireland, are absolutely (& who better authority) similar with those over whole of country. — Some species are larger &c in different countries. These facts show how very permanent plants | are, & this conclusion must be arrived at, when one sees a plant like *Paris quadrifolium* growing in one wood far from any other plants of same species.

Channel Isl. (& probably Isle of Man) no plants peculiar to themselves, this remarkable compare it with Canary Isld, Galapagos. — Iceland has same uniformity. | Primrose & Cowslip quite wild but they affect different localities, — latter on banks & in damp parts, both propagated by seeds. — There are two Dandelions which just lately have been shown to be same — one grows in marsh & other dry ; yet if *T. palustris* be sown in dry station it will for some generation come up so. — There are not many intermediate shades in these case, but absolute species formed. The *Anagallis* perhaps offers another case of permanent varieties in wild state. —

195 The two | former produced by difference of station. Varieties chiefly produced by cultivating parent in *rich* soils & then seeds produce variety.

Wild carrot made into biennial domesticated kind with large root by sowing it at wrong time of year & manuring it. — Epigonous & perigonous are very important in classification. Here we have generative organs first character.

In dioecious plants many of the female flowers unimpregnated Babington.⁴ |

196 We see gradation to mans mind in Vertebrate Kingdom, in more instincts in rodents than in other animals ; & again in mans mind, in different races being unequally developed. — ? is not elephant intellectually developed amongst *Pachydermata* like man amongst monkeys or dog in *Carnivora*. —

¹ John Gould. Probably personal communication.

² John Stevens Henslow. Probably personal communication.

³ Charles Cardale Babington. "A notice, with the results, of a Botanical Expedition to Guernsey and Jersey in July and August 1837", *Mag. Zool. Bot.*, vol. 2, 1838, p. 397.

⁴ Charles Cardale Babington. Reference untraced.

Man in his arrogance thinks himself a great work worthy the interposition of a deity. more humble & I believe truer to | consider him created from animals.

Insects shamming death most difficult case to imagine how art acquired. — Only reason however on this to a degree. Mem. spider only dropping where ground thick. — Shamming death it is but being motionless. How is instinctive dread it is exceedingly doubtful whether animals have any fear of death or of pain of death acquired? The S. American dung beetles will each become the father of many species, a few eggs transported to the St. of Magellan. — Change of habits in Van Diemens Land. |
 198 Study Mr. Blyths papers on Instinct.¹ — His distinction between reason & instinct very just; but these faculties being viewed as replacing each other it is hiatus & not saltus. —

The greater individuality of mind in man is analogous to greater individuality of bodies of some animals over those of others. — The mind of different animals less divided. — But as man has hereditary tendencies, his mind is still only, divided body.

P. 3 language seems to supply instincts, — & those powers which allow of acquirement of language hereditary, acquirable. — therefore mans mind not so different from that of brutes.

Hard to say what is instinct in animals & what reason, in precisely same way not possible to say what habitual in man & what reasonable. Some action may be either in same individual. |

199 P. 7, is not squirrel hoarding & killing grain acquirable through hoarding from short time. — My theory must encounter all these difficulties, knowing that animals have some reason, & actions habitual. it surely is not worthy interposition of deity to teach squirrel to kill ears of corn. According to my views, habits give structure, ∴ habits precede structure, ∴ habitual instincts precede structure. — duckling runs to water before it is conscious of web-feet. —

P. 7 Mr. Blyths arguments² against squirrel using reason in hiding its food is applicable to any habitual action even which man performs, — child striking a post in passion. —

Habit instinct gained during life. — do elephants easily acquire habits is this the key to their mental powers?

p. 8 mistakes of instinct are external contingencies where the habit is not applicable. |

200 The degree of development of all animals of same class being about equal, — organs of generation about equally complicated. —

An Entomologist going into a country & collecting thousands & tens of thousands new insects, perhaps scarcely one new family & no new order. — Wonderful, partly explained on my theory, & otherwise mere fact creator chooses so to create. —

It is very remarkable, with so much death, as has gone on, no greater gaps. — External conditions to be sure have remained somewhat similar. — !!! |

201 My theory drives me to say that there can be no animal at present time having an

¹ Edward Blyth. "On the Psychological distinctions between Man and all other animals; and the consequent Diversity of Human Influence over the inferior ranks of Creation, from any mutual and reciprocal Influence exercised among the latter." *Mag. Nat. Hist. Lond.*, vol. 1, 1837, p. 1.

² Edward Blyth. *Ibid.*

intermediate affinity between two classes. — there may be some descendant of some intermediate link. — the only connection between two such classes will be those of analogy, which when sufficiently multiplied become affinity yet often retaining a family likeness, & this I believe the case. — Any animal really connecting the fish & mammalia must be sprung from some source anterior to giving off of these two families, but we see analogies between fish. — Birds same remarks. |

- 202 Characters of analogy, — last acquired, — or aberrant, therefore more easily modified. — This is not easily told, for any small family having analogous characters, might be multiplied. — We must argue reversely: *where character variable* it is (one of analogy or) *lately acquired*. In pigs number of vertebrae subject to variation therefore lately acquired.

I fear great evil from vast opposition in opinion on all subjects of classification, I must work out hypothesis & compare it with results; if I acted otherwise my premises would be disputed. — According to Principle of last page osculant groups between two circles of equal value must be so from characters of analogy. — See my notes on p. 37 of Macleay.¹ Wonderfully accordant with fact there stated only in most discordant groups. |

- 203 The formation of genera may sometimes be due to accident as submersion of land containing all of intermediate Father-species, & not, therefore, solely owing to such interm. father-species being little adapted to some physical change. — If Patagonia became fertile all intermediate species living there would be destroyed, & N. & S. existing species become fathers of genera — Whatever the cause is, any osculant species which survived would be few in number. —

- 204 Parallel of Japan, near Himalaya, & European forms on that Isl^d. | The *races* of men differ chiefly in colour, form of head & features (hence intellect? & what kinds of intellect) quantity & kind of hair forms of legs — hence the father of mankind probably possessed a structure in these points for a less time than other points. — female genital organs, — make abstract on this subject from Lawrence,² Blumenbach³ & Prichard.⁴ In some monkeys clitoris wonderfully produced. — Now we might expect that animal half way between man & monkey would have differed in hair colour & form of head & features; but likewise in length of extremities, how are men in this respect upper & lower, which I do not know whether it differs in present races, & form of feet.—Negro or father of negro probably was first black at base of nails & on white of eyes. —

Will he say creation is at end seeing that Tertiary geology has obeyed rules of modern causes & considering over the vicissitudes of present animals. He would be bold. I will venture to say unphilosophical. |

- 207 A question of immense difficulty is whether Apterix descend from same parent with other birds, or branched off anteriorly. think what principles are there to guide in this opinion? *Excellent principle of abortion*.

¹ William Sharp Macleay. *Horae Entomologicae*, London 1819, p. 37 :—"These genera I propose to call *osculantia*, from their occurring as it were at the point where the circles touch one another".

² William Lawrence. *Lectures on physiology, zoology, and the natural history of man*, London 1819. This edition was suppressed.

³ Johann Friedrich Blumenbach. *A Manual of the Elements of Natural History*. London 1825.

⁴ James Cowles Prichard. *Researches into the physical history of Man*, London 1813.

Isolation of range tends to alteration view. — ostriches ditto but then there may have existed series between Apteryx & other birds. — Will having many trifling characters in common with other birds reveal the secret. — Now all the different forms of Synalaxis trifling characters as red band on wing show to be from one parent — same form of beak &c without these trifles, it would not then be told whether not descended
 208 from long way back. — aberrant forms produced when many species | but when much death, may be inferred much time elapsed &, therefore descended from branch high up. — Such probabilities only guides. — Yet trifles are produced by circumstances. *Spines* on Echidna, when it can be traced through series then probably hereditary & not produced by circumstances.

In Ostrich which is not isolated we must suppose the changes from typical structure have either been more rapid than in all other birds, or that it sprung from a branch high up. This argument not applicable to Apteryx, but source of error for only |
 209-210 excised.

211 organic matter — have & which thinking principle seems to be given a assumed according to a more extended relations of the individuals, whereby choice with memory *or reason?* is necessary — which is modified into endless forms bearing a close relation in degree & kind to the endless forms of the living beings. We see thus unity in thinking and acting principle in the various shades of separation between those individuals thus endowed & the community of mind even in the tendency to delicate emotions between races. — recurrent habits in animals. —

Animal magnetism principle of irritation, *sleep walking*, fits, laughter, &c &c. Man & man may have some relation together as well as man & child, polypus &
 212 polypus, bud & bud, polypus & germ, plant & seed. — | Instincts in young animals well developed, just like habits easily gained in childhood. — Young salmon first a species which lived in estuaries. its tastes taught it to go to saltier water (& its necessities teach it taste, but that a much more general argument) & therefore down the stream follow ebb tide, therefore got into habit of going down stream which would last were the stream 1000 miles long.

A monkey (Baboon) at Z. garden upon being beaten behaved very differently from a dog, more like man. continued long in a passion & looked out for him to come again, very different from dog, perhaps being in passion chief difference. |
 213-216 excised.

217 before, then there always have been gaps, & there now must be, ∴ extinction of species bears relation to existence of genera &c &c. Discussion useless, until it were fixed what a species means. Two savages, two species, — civilized man may exclaim with Christians we are all Brothers in spirit, all children of one father, — yet differences carried a long way.

Case of habit: I kept my tea in right hand side for some months, & then when that was finished kept it in left, but I always for a week took off[f] cover of right side though my hand would sometimes vibrate seeing no tea brought back memory — old habit of putting tea in pot, made me go to tea chest almost unconsciously. — Why do absent [minded] Dr Black tea & sugar people reverse habits. |
 218 Insects & birds are the only two tribes fitted for water, air & land (Macleay has this remark).

Mem. number 5 here most evident!!? Examine into this case. L^d Jeffrey¹ (*Life of Mackintosh*, vol. II, p. 495) — [“] in fact in all reasonings of which human nature is the object, there is really no natural starting place, because there is nothing more elementary than that complex nature itself with which our speculations must end as well as begin ” &c &c. The centre is everywhere & the circumference nowhere as long as this is so — !! Metaphysics!!! |

- 219 Mrs. Somerville² connection of Physical sciences p. 276 may be worth glancing at as she has no original idea, it will show state of knowledge. Negros existed since time of earliest Egyptian drawings & Old Testament.

Domesticated animals having *same* idiosyncrasy, cause of fertility. — varieties not produced as by nature, if so the habits which would have formed them would have arisen under different climates &c. Do I mean that idiosyncrasy of wild animals is generally different, because this difference arises a good deal from climate & habits, & therefore less fertile according to Mr Herbert's views.³

Argue case of abortive organs to mules in their genitals & even to a limb not used.

The only cause of similarity in individuals we know of is relationship, children of one parent, races of animals — argue opening case thus. |

- 220 Educate all classes, avoid the contamination of castes, improve the women (double influence) & mankind must improve. —

The areas of subsidence marked out by animals of same genera is not equal to areas of elevation : marked out by existence of elevated extinct? genera of shells. — duration in the classes however different. — |

- 221-2 excised.

- 223 & hereditary & such definite thoughts, I will never allow that because there is a chasm between man (— & chasms necessary consequence of to account for the scheme of nature) and animals that man has different origin.

Dr Royle⁴ Royal Institution seems to think Botanical Provinces will turn out not nearly so confined as now thought. — N. American, European, & Chinese genera & some species in Himalaya, some English beetle, birds & a fox most close. |

- 224 The most curious case is saxifrage, almost closely allied species Himalaya, 13000 & Melville Is^d. —

West Africa & India some plants same.

¹ Lord Francis Jeffrey. Robert James Mackintosh : *Memoirs of the Life of the Right Honourable Sir James Mackintosh*, London 1836. In chapter VIII there is a letter to the editor by The Hon. Lord Jeffrey, p. 491. Darwin's quotation is on p. 496 of the second edition.

² Mary Somerville. *On the connexion of the physical sciences*. London 1834. [from the 3rd edition, London 1836, p. 286] :—“ . . . nothing is more remarkable than the distinctions which characterise the different tribes of mankind, from the ebony skin of the torrid zone to the fair and ruddy complexion of Scandinavia, — a difference which existed in the earliest recorded times, since the African is represented in sacred writing to have been as black as he is at the present day, and the most ancient Egyptian paintings confirm that truth ; yet it appears from a comparison of the principal circumstances relating to the animal economy or physical character of the various tribes of mankind, that the different races are identical in species. Many attempts have been made to trace the various tribes back to a common origin, by collating the numerous languages which are, or have been spoken. . . . ”

³ William Herbert. *Amaryllidaceae ; preceded by an attempt to arrange the Monocotyledonous orders, and following the Treatise on Cross-bred Vegetables, and Supplement*, London 1837, p. 343.

⁴ John Forbes Royle. “ Illustrations of the Botany and other branches of the Natural History of the Himalayan Mountains, and of the Flora of Cashmere ”. *Journ. Roy. Geogr. Soc. Lond.*, vol. 5, 1835, p. 361. The significance of the words “ Royal Institution ” is not clear.

America. See Brown Congo Expedition :¹ 400 Australian plants found in other parts of world.

Athenaeum June 3^d 1838 quotes Mr. Turpins² assertion that globules of milk produce a plant capable of growing!! & propagating itself.

In Tropical countries (as St. Jago Cape de Verdes) the shells in equal periods with Europe would probably have changed much less. — Here is an |

225-230 excised.

231 Henry Thompson³ tells me best way to improve cattle is to cross between a good bull & the provincial breed, & the first offspring thus produced are better than those bred in & in, — which looks as if qualities were not permanent in the new cross. — In the Bantam clubs they used to fix on the kind wanted, colouring of each feather, weight & size & they would produce number agreeing almost to the point in question. — Merely picking opposite qualities, with no other means whatever. — |

232 Individual man & animals could only exist by habit — therefore same principle transferable not wonderful.

According to my view because actions are constant they are instincts and not ∴ instincts constant.

? whether mutilations non-hereditary & variation produced in short time in some extent counterpart, mutilation being variation produced in shortest possible time.

Mr. Willis⁴ long-eared little dogs, I am told, go to heat, take dog but do not become
233 impregnated | & puppies delicate. — they cross sister & brother of same litter, those of different litters or of father & child are thought to be unhealthy — puppies become very small, idiots, & bandy legged by this long breeding in. Hope⁵ says must not trust him that genus of parasite to genus of animals different (p. 234), different species to different, — inguinal louse African — European different. — those 2 breeds differ Africa Australia.

Parasites die when brought over on tropical animals, which account for the species changing ∴ because mammalia can subsist where parasite [. . ?].

Read Entomological Transactions. |

234 Why if louse created should not new genus have been made, & only species. Good argument for origin of man one. —

Is the *extinction & change of species* two very different considerations. with respect to law of mammals shorter duration than molluscs. argue case both in Europe & S. America. very difficult case. Does this law of duration apply to utter extinction

¹ Robert Brown. "Observations, Systematical and Geographical, on Professor Christian Smith's collection of Plants from the Vicinity of the River Congo", *Narrative of an Expedition to explore the River Zaire, usually called the Congo in South Africa in 1816 under the direction of Captain J. K. Tuckey, R.N.*, London 1818, Appendix v, p. 420.

² Jean-Pierre-François Turpin. "Recherches microscopiques sur l'organisation et la vitalité des globules du lait; sur leur germination, leur développement et leur transformation en un végétal rameux et articulé." *Comptes Rendus Acad. Sci.*, Paris tome 5, 1837, pp. 822-837. Darwin's reference to the *Athenaeum* of 3 June 1838 is incorrect, and should read June 2 where on page 396 M. Turpin's assertion is quoted.

³ Henry Thompson. Unidentified.

⁴ Mr. Willis was the name of the hairdresser in Great Marlborough Street where Darwin was then living at No. 36. His Third Notebook on the Transmutation of Species (p. 163) has another reference to the breeding of dogs.

⁵ Frederick William Hope. The reference is presumably: "On Insects and their larvae occasionally found in the Human Body". *Trans. Entom. Soc. Lond.*, vol. 2, 1837-40, p. 256.

or rapidity of specific change? he first would be called generic & other specific extinction. — |

235 In the Entomostraca¹ (Magazine of Zoology & Botany) where several generations are produced in succession (13?) without impregnation, therefore sexual passion must arise after long interval, very good case. — habit is awakened by association (case of Elephant which had run wild in India in Heber?)² is analogous to dormant instinct. — (How wonderful a case bees developing sex of neuters). Species may have had their infancies as well as men, when habits much more firmly impressed we see in the Entomostraca. The sexual curiosity of the orang outang (in June 1838[]) when young male was added good instance of instinct showing itself, not from instruction. |

236 Even the action of the viscera under sympathetic nerve may be instinct or habits. ? Are sympathetic nerves & nervous system of insects analogous? — Even plants have *habitual* actions. — this very important in considering how children come to suck or other actions in foetus of mammalia, or chick eat.

Generation becomes necessary when organs of parent are concentrated in different parts & scission cannot effect the process. — scission in all cases probably gemmation (*Ehrenberg*) but why two sexes — not necessary to generation (latent with no relation to time) as in buds. — I can scarcely doubt final cause is the adaptation of species to circumstances by principles, which I have given |

237-242 excised.

243 Study Bell on Expression³ & the Zoonomia⁴, for if the former shows that if a man grinning is to expose his canine teeth (this may be made a capital argument if man does move muscles for uncovering canines), no doubt a habit gained by formerly being a baboon with great canine teeth. — Blend this argument with his having canine teeth at all. — This way of viewing the subject important. — Laughing modified barking, smiling modified laughing. Barking to tell other animals in associated kinds of good news, discovery of prey. arising no doubt from want of assistance. — crying is a puzzler. — Under this point of view expression of all animals becomes very curious — a dog snarling in play. — |

244 Hensleigh⁵ says the love of the deity and thought of him or eternity only difference between the mind of man & animals. — yet how faint in a Fuegian or Australian! Why not gradation. — No greater difficulty for Deity to choose when perfect enough for future state, that when good enough for Heaven or bad enough for Hell. — Glimpses bursting on mind & giving rise to the wildest imagination & superstition. — York Minster story of storm of snow after his brothers murder, — good anecdote.⁶

¹ William Baird. "The Natural History of the British Entomostraca", *Mag. Zool. Bot.*, vol. 1, 1837, pp. 35, 309, 514. On p. 522 :—"They must either therefore, be hermaphrodite, or, as in some other genera, as the *Daphnia* for instance, one copulation suffices not only to impregnate the female for life, but succeeding generations also."

² Reginald Heber. *Journey through the Upper Provinces of India, from Calcutta to Bombay*, 1824-5, (with notes on Ceylon); to Madras & South Provinces, 1826, & *Letters written in India*. London 1828.

³ Sir Charles Bell. *Anatomy and Philosophy of Expression*, London 1806. Darwin referred to this subject in his *Expression of the Emotions in Man and Animals* (London 1872) on pp. 250-1.

⁴ Erasmus Darwin. *Zoonomia; or, the Laws of Organic Life &c.* London 1794-6.

⁵ Hensleigh Wedgwood. Brother of Darwin's wife.

⁶ Charles Darwin. *The Descent of Man and selection in relation to Sex*. London 1871, p. 67 :—" [York Minster] related how, when his brother killed a 'wild man', storms long raged, much rain and snow fell."

Sowerby.¹ Geographical range, shells, like cryptogamic plants, of marine kinds. there are some restricted genera, but then they appears always very small ones as Trigonina in Australia or Concholepas in America. — yet many countries have far
 245 more species than other countries (*² p. 246) | as Cyclostoma in Phillippines & Amphidroma in S. America. — yet there are a few Cyclostomes & a few Amphidromas. —

This is remarkable. —

Fish & drift sea weed may transport ova of shells. — Conchifera hermaphrodite, eggs in groups. Have dioecious plants more restricted ranges than other plants. —

Many same genera confined to hot countries & many to cold. — Hence latitude is more important element than longitude. But in land & f[resh] w[ater] shells there is more confinement, thus the Naiads (study de Ferussac)³ are confined to S. America.
 246 — Mr. Sowerby says | there are some shells common to West coast of Afria & E.S. America. — get instances. — very good anomaly in range.

* ⁴What circumstances have led to formation of some species some few have been scattered over whole world.

Many shells at present day same (or according to Sowerby fine species) on coasts of N. America & England — but the fossils are not like, except in very few cases, |
 247 those of Tertiary European fossils — (so much the more remarkable, ∴ Carboniferous ones similar?). Now this is very remarkable (connect these facts with identity of land animals. these however come from Siberia). — It cannot be said American fossils more resemble those of America than of Europe, because the recent ones are so close.

Was there continent between N. America & Europe? — Norton⁵ has written on fossils of N. America. — |
 248 At the end of "*White's Selbourne*"⁶ many references very good. Also "*Rays Wisdom of God*"⁷. Often refer to these. — Also some few facts at end of "*The British Aviary*"⁸ or Bird Keepers Companion. Study *Appendix* (& only appendix) of Congo Expedition.⁹ |

249-254 excised.

255 gradually separated the birds might yet remember which way to fly. There is a kind of wren (Bebyk??) which seems common in Rocky mountains & on one lofty isolated spot on the Alleghanies to which it migrates every year ; probably a chance wanderer like the first pair of Pipe flycatcher. —

¹ James Sowerby. *The Genera of Recent and Fossil Shells, for the use of students in Conchology and Geology*, London 1820-5.

² This asterisk refers to the passage marked by an asterisk on page 246 of the manuscript below.

³ André-Etienne-Justin-Pascal-Joseph-François D'Audebard de Ferussac. *Histoire Naturelle et particulière des Mollusques terrestres et fluviatiles*, Paris 1819-51.

⁴ This asterisk marks the beginning of the sentence referred to on page 244 of the manuscript above.

⁵ Reference untraced.

⁶ Gilbert White. *The Natural History and Antiquity of Selborne, in the country of Southampton: with engravings and an appendix*, London 1789.

⁷ John Ray. *The Wisdom of God manifested in the works of Creation*, London 1691.

⁸ *The British Aviary*, London n.d.

⁹ Robert Brown. "Observations, Systematical and Geographical, on Professor Christian Smith's Collection of Plants from the Vicinity of the River Congo", *Narrative of an Expedition to explore the River Zaire, usually called the Congo in South Africa in 1816 under the direction of Captain J. K. Tuckey*, R.N. London 1818 Appendix v, p. 420.

Bachman¹ says he thinks the Mocking thrush beats all English birds in song. — one of their thrushes exceeds our blackbird, but our blackbird exceeds their other 256 thrushes, — yet they have one with very sweet notes. — | Their soft-billed birds are inferior to ours, & our lark ranks very high. — Upon the whole thinks more birds sing in England than in America, but the few of N. America are quite as beautiful. The thrushes of N. America singing so well & the mocking thrush being so very beautiful great contrast with South America. — |

257-258 *excised*.

259-264 *blank*.

265² Books quoted by *Herbert* p. 338

Schiede in 1825 & Lasch. Linn. in 1829 has given list of Spontaneous Hybrids. where ?

Sweet. Hortus Britannicus has remarks on acclimatizing of Plants.

Herbert p. 348 gives reference to Kohlreuter's Papers

Wiegman has published German pamphlet on crossing Oats, &c

Mr. Coxe "Views of the Cultivation of Fruit trees in N. America" in Lib. of Hort. Soc.³

Mc Neil has written good article on Horticulture in Edinburgh Encyclop. — Horticulture Journal

The British & Foreign Medical Review No. XIV April 1839. — Review on "Walker on intermarriage", price 14s.

March 20th 1839. Philosophy of Blushing lately advertised /6s

Mrs. Necker on Education preeminently worthy of studying in metaphysical point of view

Henslow has list of plants of Mauritius with locality in which each one is found. Very good to see whether peculiar plants in high points |

266 Institution of Paris with respect to licentiousness destroying children, — it is not effect, as Lyell suggested, of organs being worn out as otherwise old couple would not have children

Turner's embassy to Thibet, perhaps worth reading, quoted by Malthus. —

Heberdens Observat. on increase & decrease of different diseases 4^{to} 1801. — quoted by ditto. —

There appears to be good art. on Entozoa by Owen in Encyclop. of Anat & Physiology. —

Dampier probably worth reading

Lessings Laocoon (translated in 1837) on limits of painting & poetry. — Erasmus thinks I should like it.

The Sportsman's Repository 4^{to} contains much on dogs. —

Reports of Brit. Assoc. — some important Papers.

Dr Mayo. Pathology of Human Mind. —

¹ John Bachman. Reference untraced.

² From this point the succession of pages is inverted, because Darwin wrote these pages by working forwards from the end of the notebook.

³ William Cox of Burlington, New Jersey. *A view of the cultivation of fruit trees, and the management of orchards and cider*, Philadelphia 1817.

Audubons Ornithological Biography 4 volumes well worth reading

Bevans work on Bees, new edit 1838

Harlaam [Harlan] Physical & Medical Researches on Horse in N. America. —
Owen has it —

Ld. Brougham. Dissertations on subject of Science connecting with Natural
Theology, — on instinct & animal intelligence, — *very good*.

Endlicher has published in first volume of annalen of Vienna, sketch of South
sea Botany

267 R. Brown has curious *coloured* maps by Copenhagen Botanist of range of plants |
Silliman's [American] Journal [of Science]

Rengger on Mammalia of Paraguay, account wild cattle &c

Montagu on birds (facts about close species).

Wilson's American Ornithology

Read Aristotle to see whether any my views is ancient?

Study with profound care *abortive* organs produced in domesticated plants, where
function has ceased to be used as tendrils into stump

Library of Useful Knowledge, Horse, Cow, Sheep

Vesey Philosophie d'Histoire Naturelle

Marcel de Serres Cavernes d'Ossements 3rd edit. Octavo (good to trace European
forms compared with African)

Annals [of natural history]

Histoire Generale et Particuliere des Anomalies de l'organisation des Hommes
et les animaux. by Isid. Geoffroy St. Hilaire 1832 contains also his fathers views.
Quoted by Owen. —

Hunter has written quarto works on physiology besides the papers collected
by Owen (at Shrewsbury)

Yarrells Paper on change of plumage in the Pheasants Philosoph Transactions
1827 [vol. 118]

Paxton on the culture of Dahlias

Mrs. Gore on roses might be worth consult.

Paper on Consciousness in Brutes in Blackwood, June 1838

H. C. Watson on Geograph. Distrib : of British Plants.

Humes Essay on H[uman] Understanding (some time)

Du[gald] Stewart works & lives of Reid, Smith & giving abstracts of their views

Mackintosh Ethnical [Ethical] Philos : |

268. To be read

Humboldt[t]. New Spain — much about *castes* &c

Richardson's Fauna Borealis

Entomological Magazine (paper on geograph range)

Study Buffon on Varieties Domesticated animals see if laws cannot be made out

Find out from Statistical Society where M. Quetelet has published his laws about
sexes relative to age of marriages

Brown at end of Flinders & at end of the Congo Voyage

Decandolle Philosophie on Geographical distrib in Dict. Sciences Nat. in Geolog Soc.

F. Cuvier on instinct

- L. Jenyns paper in Annals of Nat. History
 Prichard. — Lawrence
 Roy St. Vincent vol. iii p. 164 on unfixed form.
 Dr Royle on Himalaya types.
 Smellie. Philosophy of Zoology
 Flemming. ditto
 Falconers remark on the influence of climate
 Whites regular gradation in Man.
 Lindleys introduction to the Natural System
 Bevan on honey bee
 Dutrochet memoires sur les vegetaux et animaux — on *sleep* & movements of
 Plants £1 . 4s
 Voyage aux terres Australes chapt. xxxix, tom iv. p. 273 [Peron . . .]
 Latreille Geographie des insectes 8° p. 181
 Sept. 17 [1839] For references to authors about E. Indian Islands consult Dr
 Horsfield |
 Sir G. Staunton's Embassy to China Oct. 12th [1838]
 Kotzebues two voyages, *skimmed well* ditto
 Lutkes Voyage, carefully read. —
 Reynolds Discourses
 Lessings Laocoon
 Whewell's inductive History. References at end of each vol
 Herschel's introduction to Natural Philosophy
 R. W. Darwin's Botany. — references at end
 Mayo Pathology of the Human Mind
 Evelyn's Sylva, skimmed stupid
 Brown's travels in Africa ; well skimmed.
 1839
 Jan. 10th All Life of W. Scott, except the V volume
 — 19th Mungo Parks Travels
 Feb. 12 Sir H. Davy Consolations in travels
 — Observations on morals of Eugenius
 — 14th Boswells Life of Johnson 4 vols.
 25th Philips Geology, 2nd vol. —
 March 16 Gardner's Music of Nature
 — Herbert on Hybrid mixture : marginal notes.
 — 20th Carlyle's French Revolution 3 ? vols oct :
 — 26th Blumenbach's Essay on Generation. English Transla.
 — The Rev. A. Wells Lecture on instinct
 — Clive on the Breeding of animals
 — Spallanzanis Essay on Animal Reproduction
 — Treatise on Domestic pidgeons
 — 30th Lives of Hayd[n] & Mozart
 April 25th Lockarts Life of Napoleon.
 „ 5th Dr Edwards influence of physical causes, well skimmed

- Bartrams travels in N. America
- May 18th Stanley familiar History of Birds
- Mackintosh's Ethical Philosophy
- Bell's Bridgewater Treatise
- Wilkinson's Egyptian remains skimmed
- Pliny Nat. Hist of world ditto
- „ „ Lamarck II vol Philos. Zoology references at end of each chapter
- Crabbes Life

270

- June 1st King & Fitzroy |
- Rays Wisdom of [God]
- Lisiansky's Voyage round World. 1803-6. nothing
- Lyells Elements of Geology
- Gibbons Life on himself
- Hume's ditto with correspond. with Rousseau
- Miss Martineau How to observe
- Mayo Philosophy of Art of Living
- Several of Walter Savage Landors Imaginary Conversations very poor
- Sir J. Browne's Religio Medici
- Lyell Book III there are many marginal notes
- Rengger & Mitchell's Australia
- Walter Scotts Life 1st 2nd & 7th volumes
- Abercrombie on the Intellectual Powers.
- Hunters Universal Oeconomy edited by Owen. read several papers all that bear
- on any of my subjects
- Elie de Beaumont 10 vols of Memoires on Geology of France on Etna almost re-
- read the previous volume & C. Prevost on l'Ile Julie
- Waterton's Essays on Natural History Octob 2^d [1838]
- Transactions of Royal Irish Academy ditto
- Lavater's Physiognomy Octob 3rd
- Malthus on Population
- W. Earl's Eastern Seas. Octob 12th |

271-274 excised :

275

- Sir J. Sebright's Pamphlets } not abstracted
- Wilkinsons on cattle }
- Scientific Memoirs published by Taylor
- Magazine of Zoology & Botany & continuation
- Annals of Natural History
- Skimmed von Buch travels
- Whites Natural History of Selbourne References at end
- Dr Langs Australian tract, skimmed
- Macleays Horae Entomologicae
- Rays Wisdom of God references at end
- The British Aviary — ditto
- Lisle's Husbandry
- Tuckey Voyage reread Appendix

Ovington Voyage to Surinam

Voyage Congo Expedition Zaire except Browns Appendix & excellent table of Canary Island plants

Home's History of Man

Transactions of the Entomological Society vol. I & 1st no. of vol. II (read remainder) when out |

276 Most of those which have references at end, is so said to have

Books examined with ref : to species

Mackenzie's Iceland

Molinas Chile

Falkner Patagonia

Azara Voyage & Quadrupeds of Paraguay

Dobrizhoffer Abipomnes

Edinburgh New Phil. Journal about 13 numbers have been read

Voyage a l'isle de France

{ Voyage de l'Astrolabe

{ Partie Zoologique

Pernety voyage a l'isle Malouines

Zoological Journal 5 vols

Voyage de la Coquille

Zoological Transactions up to parts published March 1838. done

Whole of Geographical Journal

Asiatic Journal to end of 1837, read. contains very little

Macleay's letter to Dr Fleming & Review of letter in Quarterly |

Inside Back Cover :

Read Volney's Travels in Syria vol 1, p 71. account of European plants transported —

Crawford. Eastern Archipelago probably some account

Raffles Sir S. ditto ditto —

•• Buffon suites

Line on the improvement of domesticated animals

Fries de plantarum praesertim crypt. transitu et analogior commentalia

Library of Useful Knowledge on horse & cow & sheep

Clarke's travels

Temmincks Hist. Nat. des Pigeons et des Gallinacés

Sillimans Journal during 1837. paper by Bachman on migration of birds [vol. 30 July 1836, p. 81.]

Temminck has written Coup d'Oeil sur la faune des iles de la sonde et de l'empire du Japon

Wowett on cattle — (Waterhouse has it)

Shells from Bernier Island many relations with a *living* Natica & many shells of genera Corbula, Chama, Cardium, Porcellana, Turbo, Cerithium

Jardin du Roi

Java fossils at same time

Study Botanical works on Buds & Gemmae



PRINTED IN GREAT BRITAIN BY
ADLARD AND SON, LIMITED,
BARTHOLOMEW PRESS, DORKING

DARWIN'S NOTEBOOKS
ON TRANSMUTATION OF
SPECIES
PART III



Edited with an Introduction and Notes by
SIR GAVIN DE BEER

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
HISTORICAL

Vol. 2 No. 4

LONDON: 1960

DARWIN'S NOTEBOOKS ON
TRANSMUTATION OF SPECIES
PART III. THIRD NOTEBOOK
JULY 15th 1838—OCTOBER 2nd 1838

Edited with an Introduction and Notes

BY

SIR GAVIN DE BEER

Pp. 119-150



BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
HISTORICAL
LONDON : 1960

Vol. 2 No. 4

THE BULLETIN OF THE BRITISH MUSEUM
(NATURAL HISTORY), *instituted in 1949, is
issued in five series corresponding to the Departments
of the Museum, and an Historical Series.*

*Parts will appear at irregular intervals as they become
ready. Volumes will contain about three or four
hundred pages, and will not necessarily be completed
within one calendar year.*

This paper is Vol. 2, No. 4 of the Historical series.

© Trustees of the British Museum, 1960

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued July, 1960

Price Twelve Shillings

DARWIN'S NOTEBOOKS ON TRANSMUTATION OF SPECIES

Edited with an Introduction and Notes by

SIR GAVIN DE BEER

PART III. THIRD NOTEBOOK (JULY 15TH TO OCTOBER 2ND 1838)

INTRODUCTION

DARWIN began his Third Notebook on Transmutation of Species on 15th July 1838 and finished it on 2nd October of the same year. From the list of books read, appended to the Second Notebook, it is known that he did not read Malthus's Essay on Population before 3rd October 1838, from which it can be seen that the contents of the Third Notebook owe nothing to Malthus's work. It is therefore of great importance to note that Darwin hit on the principle of natural selection independently. After a consideration of changes resulting in the formation of new species, he wrote :—" All this agrees well with my view of those forms slightly favoured getting the upper hand and forming species " (III 175).¹ Darwin himself realized the historical importance of these lines, because at a later date, probably 14th December 1856 when he looked through his Notebook, he wrote at the head of it : " Towards close I first thought of selection owing to struggle ".

It has always been a puzzle to know why the stimulus of Malthus's book should have been necessary to put Darwin on the scent of natural selection about which Malthus knew nothing, and Darwin's Third Notebook now shows that the problem has hitherto been incorrectly formulated. From the various passages in the extant portions of the first three Notebooks it is clear that Darwin had independently grasped two ideas. One was the parallel between the effects of artificial selection by man and those of natural selection. It is contained in the Third Notebook and supported by the observation that the magnitude of the differences between domestic breeds of cattle exemplified in the hump of Indian cattle is comparable to that of the differences between the species of cattle and of bison (III 65).

The second idea was that of forms slightly favoured getting the upper hand and forming species. But it was an idea of natural selection without stress on the heavy and unavoidable penalties for failure in the struggle for existence, although the probability of extinction as the price to be paid for insufficient adaptation was already recognized in the First Notebook (I 38). It seems that it was the mathematical demonstration of the insufficiency of food supplies if numbers increased too fast, and the consequent inevitableness of the penalties, that Darwin derived from Malthus's work, not the principle of selection itself which completely undermines the validity of Malthus's own thesis that mankind was unimprovable.

¹ References are made to the Notebook on Transmutation of Species concerned in Roman figures, and to the MS. pages in Arabic figures.

The proof of the correctness of this interpretation of the story is to be found in the letter¹ which Darwin wrote to Wallace on 6th April 1859, in which he explained that after reading Malthus's book he "saw at once how to apply the principle of natural selection". He had already grasped the principle of natural selection and had seen how it could result in unlimited change away from the ancestral type and the production of new species; but he had not recognized how nature enforced it until he read Malthus.

The Third Notebook contains a number of passages which reveal Darwin's outlook on his own work and that of his predecessors. The most important is the following:—"Seeing what von Buch, Humboldt, G. St. Hilaire & Lamarck have written I pretend to no originality of idea (though I arrived at them quite independently & have used them since) the line of proof and reducing facts to law only merit if merit there be in following work." (III 69). These words come early in the Third Notebook and refer to the period *before* his discovery of the principle of natural selection. They are in complete agreement with what Darwin wrote² to Baden Powell twenty eight years later, after the publication of the *Origin of Species*:—"No educated person, not even the most ignorant, could suppose that I meant to arrogate to myself the origination of the doctrine that species had not been independently created. The only novelty in my work is the attempt to explain *how* species became modified, & to a certain extent how the theory of descent explains certain large classes of facts; & in these respects I have received no assistance from my predecessors."

After the *Origin of Species* was published, Darwin wrote³ to F. W. Hutton, 20th April 1861:—"I am actually weary of telling people that I do not pretend to adduce direct evidence of one species changing into another, but that I believe that this view is in the main correct, because so many phenomena can be thus grouped together and explained. . . . I generally throw in their teeth the universally admitted theory of the undulations of light . . . admitted because the view explains so much."

The stress on the value of his theory in explaining the "large classes of facts" is already made in the Third Notebook:—"In comparing my theory with any other, it should be observed not what comparative difficulties (as long as not overwhelming) [but] what comparative solutions and linking of facts" (III 71).

The Third Notebook also contains some interesting remarks on Darwin's methods. "Although no new fact be elicited by these speculations even if partly true they are of the greatest service towards the end of science, namely prediction, till facts are grouped & called there can be no prediction. The only advantage of discovering laws is to foretell what will happen & to see bearing of scattered facts." (III 67).

Much ink has been used to argue the question whether Darwin arrived at his conclusions as a result of inductive processes of reasoning. Writing at a time when so-called Baconian principles of induction were widely thought to be the only "correct" method of scientific inquiry, Adam Sedgwick⁴ accused Darwin of deserting

¹ *More Letters of Charles Darwin*, edited by F. Darwin and A. C. Seward, London 1903, vol. 1, p. 118.

² Sir Gavin de Beer. "Some unpublished letters of Charles Darwin", *Notes and Records of the Royal Society of London*, 1959, vol. 14, pp. 12-66.

³ *M. L.*, vol. 1, pp. 183, 184.

⁴ *Life and Letters of Charles Darwin* edited by Francis Darwin, London 1887, vol. 2, pp. 247-250.

these principles and used this argument for the express purpose of discrediting the theory of evolution by natural selection. Other critics, more recent, have accepted Darwin's conclusions but claimed that he was mistaken in thinking that he had arrived at them inductively and even reproached him for "speculating" in his Notebooks, as if it was reprehensible. Darwin himself always maintained that he had used induction and wrote¹ in his Autobiography that he "worked on the true Baconian principles, and without any theory collected facts on a wholesale scale". This did not mean that he must refrain from basing a hypothesis on each fact as he came to it, if he could. In the Notebooks he explained his method of working quite clearly: "The line of argument often pursued throughout my theory is to establish a point as a probability by induction & to apply it as hypotheses to other points & see whether it will solve them" (III 117). This is precisely what the Notebooks show. An authority is quoted for some observation believed to establish a fact, and immediately Darwin began asking questions suggested by the fact to see if a hypothesis constructed *ad hoc* was applicable to other situations. The Notebooks are littered with these queries.

Later in his life, in a letter² to Sir John Fiske dated 8th December 1874, Darwin described his method more explicitly but less correctly: "my mind is so fixed by the inductive method, that I cannot appreciate deductive reasoning. I must begin with a good body of facts and not from principle (in which I always suspect a fallacy), and then as much deduction as you please." In place of "deduction" he should have said "hypothesis and deduction". The hypotheses and deductions can follow immediately from each fact.

The facts and the tentative hypotheses based on them follow one another pell mell through the Notebooks, and the attempts to reprove Darwin for speculating in his Notebooks are futile. He was seldom more than one jump ahead of his facts, and it was precisely because he was one jump ahead that he made progress. As Darwin wrote³ to Lyell, 1st June 1860, referring to a paper by Hopkins who refused to accept the explanatory value of a theory as evidence of its correctness: "on his standard of proof, natural science would never progress, for without the making of theories, I am convinced there would be no observations". In a letter to Henry Fawcett, 18th September 1861 Darwin wrote:⁴—"About 30 years ago there was much talk that geologists ought only to observe and not theorise; and I well remember some one saying that at this rate a man might as well go into a gravel pit and count the pebbles and describe the colours". When Darwin was speculating without a firm basis of fact he was careful to warn himself: "*Pure hypothesis* be careful" (III 58).

In a masterly study of the problem, Alvar Ellegård⁵ has shown that the method of hypothesis by means of which Darwin worked was perfectly legitimate. As early as 1860 T. H. Huxley had pointed this out:⁶ "There cannot be a doubt that the

¹ *Autobiography of Charles Darwin* edited by Nora Barlow, London 1958, p. 119.

² *L. & L.*, vol. 3, p. 193.

³ *L. & L.*, vol. 2, p. 315.

⁴ *M. L.*, vol. 1, p. 195.

⁵ Alvar Ellegård. "The Darwinian Theory and Nineteenth-Century Philosophies of Science", *Journ. History of Ideas*, 1957, vol. 18, pp. 362-393.

⁶ T. H. Huxley. *Westminster Review*, 1860, vol. 17, p. 566.

method of inquiry which Mr. Darwin has adopted is not only rigorously in accordance with the canons of scientific logic, but that it is the only adequate method". Huxley also had a rod in pickle¹ for the philosophers of science who cavilled at Darwin's method in order to try to invalidate his results:—"Critics exclusively trained in classics or in mathematics, who have never determined a scientific fact in their lives by induction from experiment or observation, prate learnedly about Mr. Darwin's method, which is not inductive enough, not Baconian enough, forsooth, for them. But even if partial acquaintance with the process of scientific investigation is denied to them, they may learn, by the perusal of Mr. Mill's admirable chapter "On the Deductive Method", that there are multitudes of scientific inquiries in which the method of pure induction helps the investigator but a very little way".

The attempts by Darwin's opponents to discredit his views by appealing to "Baconian principles of induction" as the only true path of science are particularly disingenuous. As Stanley Jevons² showed many years ago, not only are the processes of inductive and deductive reasoning inseparable in the construction of theories capable of generalisation, but they *must* be accompanied by hypothesis; and in any case it is incorrect to ascribe the principle of inductive reasoning in scientific method to Francis Bacon. Darwin was abundantly justified in his procedure "of inventing a theory and seeing how many classes of facts the theory would explain."³ The Notebooks show that he had already realized the importance and value of this method.

An hypothesis is an idea based by induction on facts, in an attempt to find a consistent formula to fit other facts. Furthermore, as James K. Feibleman⁴ has stressed, "an induction to an hypothesis is just what it is quite independently of whether it was suggested by one fact or a thousand; the hypothesis itself is what is important, and depends for its staying powers upon its truth or falsity".

In Darwin's case the first three facts from which he started are known.⁵ They were the discovery by him of "great fossil animals covered with armour like that on the existing armadillos", "the manner in which closely allied animals replace one another in proceeding southwards over the Continent", "the South American character of most of the productions of the Galapagos archipelago, and . . . the manner in which they differ slightly on each island of the group". Darwin's observations and reflections on the conditions which he found in the Galapagos Islands led to his now famous entry in his Ornithological Notebook:—"When I recollect the fact, that from the form of the body, shape of the scale and general size, the Spaniards can at once pronounce from which Isd. any tortoise may have been brought:—when I see these islands in sight of each other and possessed of but a scanty stock of animals, tenanted by these birds but slightly differing in structure and filling the same place in Nature, I must suspect they are only varieties. The only fact of a similar kind of which I am aware is the constant asserted difference between the

¹ T. H. Huxley. *Lectures and Essays*, London 1908, p. 172.

² W. Stanley Jevons. *Logic*, London 1889, p. 79.

³ *L. & L.*, vol. 2, p. 241.

⁴ J. K. Feibleman. "Darwin and Scientific Method", *Tulane Studies in Philosophy*, 1959, vol. 8, p. 8.

⁵ *Autob.*, p. 118.

⁶ *Charles Darwin and the Voyage of the Beagle* edited by Nora Barlow, London 1945, p. 246.

wolf-like Fox of East and West Falkland Islands. If there is the slightest foundation for these remarks, the Zoology of Archipelagoes will be well worth examining ; for such facts would undermine the stability of species."

The problem presented to Darwin did not admit of many degrees of freedom in its solution. If the various species had not all been specially created with the observed differences between them ready-made, then they must have been produced by descent with modification from their ancestors. But this was the idea which had been put forward by Erasmus Darwin and Lamarck, extolled by Grant, condemned by Lyell, and hitherto rejected by Darwin. As Darwin explained, he independently arrived at the same idea as a hypothesis, and the First Notebook on Transmutation of Species¹ contains Darwin's earliest known formulation of that hypothesis and search for facts wherewith to test it.

The first 54 pages of the First Notebook are devoted to a straightforward exposition of the reasons which led Darwin to abandon the view of the immutability of species and to accept the hypothesis of transmutation or evolution. It is noteworthy that the three facts which started Darwin on his train of thought do not figure in this exposition, and this is a measure of the amount of consideration which Darwin had given to the problem between the time when he was in the *Beagle* and July 1837 when he opened his First Notebook on Transmutation of Species.

As the problem was one of differences between species, the first step in the analysis was the question of the origin of differences or variation. Here he found Erasmus Darwin's statement of empirical fact that variation was the natural result of sexual reproduction. But if variation occurs, deductive reasoning leads to the conclusion that species ought not to remain constant. Why, then, do species remain as constant as they do ? Hypothesis : interbreeding within the whole population quashes variation of the species away from the type. This was the nearest approach to empirical fact that the then-prevailing total ignorance of the processes of genetics allowed him to make. If interbreeding within the whole population quashes variation, then what will happen if a portion of a population is prevented from interbreeding with the remainder by geographical isolation ? Hypothesis : the portion of the population will vary, form a variety, and ultimately a new species. If this be so, then by deduction it ought to be observable that in some isolated regions this has happened. It is : the inhabitants of isolated areas such as the Galapagos Islands, Falkland Islands, Ireland, etc. show forms which are permanent varieties or different species as compared with the inhabitants of neighbouring lands.

If species are formed in this way from pre-existing species, there must be divergence in the lines of descent ; but the number of different species living together in one region cannot be unlimited : therefore hypothesis : some species should die out. They have done so ; extinction is a fact. Now if species are related to one another by common descent and some of them have gone extinct, hypothesis : there ought to be differences between the magnitudes of difference between the different species. There are : species are grouped in different ways, some close together belonging to the same genus, others wide apart belonging to different genera.

¹ *Bull. Brit. Mus. (Nat. Hist.) Historical Series*, 1960, vol. 2, pp. 23-73.

In this manner by a sequence of observation of empirical facts, induction into hypothesis, deduction, and exposure to test by a search for new facts leading to refutation or confirmation of his hypothesis, Darwin gradually acquired confidence. His hypothesis became "my theory" and he foretold the results of its establishment: a common ancestor for man and all animals, netted together by affinity (I 232).

In all this argument so far, there is no explanation how species are caused to become modified, if they are. In the First three Notebooks up to nearly the end of the Third, about 1st October 1838, Darwin was in the stage described in the *Autobiography*:¹ "it was equally evident that neither the action of the surrounding conditions, nor the will of the organisms (especially in the case of plants) could account for the innumerable cases in which organisms of every kind are beautifully adapted to their habits of life, . . . and until these could be explained it seemed to me almost useless to endeavour to prove by indirect evidence, that species have been modified."

The idea of natural selection, so far as can be seen from the extant portions of the Notebooks, seems to have occurred to Darwin as a combination of the effects on him of the facts of variation, adaptation, and extinction. Variation must result in some forms being slightly more and others slightly less favoured. If this is so, hypothesis: "of those forms slightly favoured getting the upper hand & forming species" (III 175).

Once he was in the possession of the key of natural selection, Darwin worked by a combination of induction and deduction to construct the full theory of evolution by natural selection, as Sir Julian Huxley² and I³ have shown. But this belongs to a stage in the development of Darwin's thought later than is represented by the first three Notebooks on Transmutation of Species, and is found in the Fourth Notebook, the Sketch of 1842, and the Essay of 1844.

The remainder of the Third Notebook is largely taken up with the search for facts at a time when they were lamentably few. Even the facts of fertilisation⁴ were unknown, to say nothing of genetics. In trying to acquire the elements of zoology, botany, and physiology when there were no text-books, Darwin scoured whatever he could find and was led astray as often as not. With the hindsight of a hundred and twenty years of progress of knowledge in biology, there is something rather pathetic in the spectacle of Darwin wrestling with the problem of dominance of characters of different domestic breeds when crossed (III 3, 13, 42) and the hypothesis that dominance was determined by the relative ages of the breeds (III 16, 17, 43, 49, 108); with the relative importance of paternal and maternal influence on offspring (III 8, 44); with the explanation of the sterility of hybrids (III 15, 19) and with the possibility of telegony (III 8, 172).

¹ *Autob.*, p. 119.

² Sir Julian Huxley. *The Living Thoughts of Darwin*, London 1958, p. 12.

³ Sir Gavin de Beer. "The Darwin-Wallace Centenary", *Endeavour*, 1958, vol. 17, p. 65.

⁴ Although sperms were first discovered in 1677 by Hamm, and Spallanzani's experiments proved that sperms and not the liquid in which they swam are the element responsible for fertilization, the penetration of an egg by a sperm was first observed by G. Newport in the frog's egg in 1854, and by N. Pringsheim in 1855 in an alga. It was not until 1875 that Oskar Hertwig discovered in the sea urchin that after fertilization one of the pronuclei contained in the egg is derived from the egg and the other from the sperm.

All the more remarkable, therefore, are the sound conclusions that he was sometimes able to draw :—*Regeneration* : “ each part of animal must have structure of whole comprehended in itself ” (III 130, 167) ; *degeneration* : “ as Larva may be more perfect . . . than [adult] parent, so may species retrograde ” (III 57) ; *adaptation* : “ if animals became adapted to every minute change, they would not be fitted to the slow great changes really in progress ” (III 167) ; *instinct* : “ the simplest transmission is direct instinct & afterwards enlarged powers to meet with contingency ” (III 118) ; *man* : “ comparison of man with expression of monkey when offended, who loves who fears who is curious ” (III 22), and the similarity of the sexual impulse in female animals and in women (III 99, 139).

Almost prophetic is Darwin's search for material on which to carry out researches in experimental embryology : “ cannot I find some animal with definite *life* and split it, and see whether it retains same length of life ” (III 165). It was nearly a century before Driesch and Spemann showed how this could be done.

There is something scientifically heroic in Darwin's wondering whether a man's amputated arm could not regenerate a man, if it could be kept alive in a form of tissue-culture (III 131).

As in the other Notebooks a number of pages were cut out of the Third by Darwin in 1856. Seventy two pages of it have been lost out of one hundred and eighty, but it is a matter for congratulation that the extant pages contain as much of importance as they do.

Darwin's Third Notebook on Transmutation of Species, also known as Notebook “ D ”, is Darwin MS 123 in the Cambridge University Library, to the authorities of which acknowledgement is warmly made for their unfailing assistance and courtesy, as also to Dr Sydney Smith and Mr. P. J. Gautrey for their kind and valuable help with the decipherment of some obscure passages.

Inside Front Cover

Charles Darwin 36 Great Marlborough Street 1838.

Did¹ Eyton's² hybrids when interbred show any tendency to return to either parent? Is the first cross which makes hybrids productive like geese? — Are the number of kittens between Lion & Tiger at litter as numerous as in common lion?

Are the number of nipples in domesticated very fertile animals increased? Where offspring heterogeneous in plants are the number of seeds greater? — Mem. for Eyton. — Sir R. Heron's³ case of breed of pigs with solid feet. —

(In this Book some curious note on monkeys recognizing sexes of animals.⁴)

(All selected Dec. 14 — 1856)

Towards close I first thought of selection owing to struggle |

1 July 15th 1838 Finished October 2^d.

As a proof what unknown causes act upon people my father⁵ mention that for ten years, he never saw one case of malignant erysipelas spreading over the head, not caused by a wound, when suddenly during one time he had three patients at very distant quarters of the county, who had had no sort of communication, were seized with it, & for ten years afterwards, he then did not see other cases. — He

2 thinks Apoplexy affects people all over England at same periods. | When he began practice, he remember during a year or two he saw many cases of virulent cancer in women, & since that time it has been rare disease, but now (July 1838) he has seen more cases in a month, than in several previous years, two having consulted him on one day. — |

3 Mark⁶ at Shrewsbury thinks the half bred Alderney cows take more after Alderney than the Durham, with which they have been crossed — is Alderney oldest breed — He believes all pretty much alike. — My Fathers Water in the brain⁷ a century since used to be called Worm Fever, as used much more lately diseased mesatine glands. — My Father has seen case of pleurisy, broken limb in children & other such disorders accompanied with some fever, be attended by the transmission of
4 large number of worms | the child not having passed them before. Hence disordered intestines are not healthy to worms, (like parasites of Tropical countries cannot endure this climate). —

July 23rd. Eyton,⁸ a stone blind horse, seemed to perceive turn on road where no houses to Caton Muscote, where he had been accustomed to turn down, — applicable to birds migrations & mistakes in Savages. |

5-7 excised.

8 [*sic*] When two dogs line the same bitch & perfect spaniels & setters are produced one would argue the whole effect of race was determined by male : & How completely is Lor^d Moreton's⁹ case opposed to this fact & views.

¹ The remaining words on this cover inserted at a later date.

² Thomas Campbell Eyton.

³ Sir Robert Heron. cf. *Variation of Animals and Plants under Domestication*, London 1868, vol. 2, p. 92. Footnote :—" Extract of a letter from Sir R. Heron, 1838 given me by Mr. Yarrell ".

⁴ This and the following two sentences, inserted in pencil at a later date.

⁵ Robert Waring Darwin.

⁶ Mark, Dr Darwin's coachman at Shrewsbury. cf. *Emma Darwin*, Cambridge 1904, vol. 2, p. 13.

⁷ " Water in the brain " appears to have been Dr. Darwin's term for this disorder.

⁸ Thomas Campbell Eyton. Probably personal communication.

⁹ Lord Morton. " A Communication of a singular fact in Natural History ", (read November 1820) *Phil. Trans. Roy. Soc.*, 1821, vol. cxi, p. 20.

Fox¹ says a cousin, one of Mr. Strutt of his used to breed to common & Muscovy Ducks. — English, China & Canada Geese, & that this first cross were *equally* fertile with pure bred animals. — Mem. number of mules. — He recollects one hatch of
 10 hybrid geese very fine. — How is it | with plants? This indicates a remarkable law, that first cross plentiful, second absolutely sterile. —

My case of stallion, according to Erasmus² preferring young mare to old, explained by stallion (according to Fox) being guided entirely by their smell.

Fox³ says he knew a carter well who placed his stallion as second horse between shaft mares |

11-12 *excised*.

13 Fox⁴ says where common & China geese are crossed the neck is not intermediate in its peculiar long neck, but much nearer to common goose. —

What has long been in blood, will remain in blood, — converse, what has not been, will not remain, — yet offspring must be somewhat like parents, — therefore offspring will tend to go back, or have none, — this argument does not apply to first
 14 parents, because they are not new breed. — the first hybrids may be | compared to animal with amputated limb. Hereditary six-fingered people, Lord Renwick[?] family with defective palates, hereditary & therefore exceptions to above law. — Study what these monsters are : — are they abortive twins. — The fertility of first cross, as stated by Fox, is very important, as showing above facts as first cross being new species. —

15 Are not dreadful monsters abortive, just like *mules*. | Fox's⁵ half bred Persian cats favour the Persian side. — Theory of abortive hybrids. — If mules did breed the offspring would as in all other animals be like either parent or intermediate within certain small limits (within which limits they might return to either parent). Then according [to] law, that in proportion as things are long in blood so will they remain, a mule being new species will have every tendency to have offspring like parent, but as they must [be] like or there will be none, therefore a mule can have no offspring. — But as badly deformed people & as mutilations (produced very quickly) sometimes have similar offsprings, so will the worst mules (as real mule) have offspring. — Slight deformities as supernumerary fingers (that is slight alteration of primitive stocks related to changes which every species undergoes) & hybrids between very near *species* (that is slight alterations of primitive stock) are hereditary : Hybrids & Varieties is different because not long in blood. —

16 The case of union of perfect animals is | distinct case, — gradation from physical impossibility to (*perhaps increased*) fertility — (but many animals are fertile, — when offspring infertile, — two considerations are here combined.). In last page, we have seen [that] mules could have no offspring, & this being [the] case, owing to the correlations of system, the organ of generation would necessarily fail. — In last page, I should have said, “an animal is able to transmit only those peculiarities
 17 to its offspring, which have been *gained slowly*, now all the mules | have their whole

¹ William Darwin Fox. Darwin's second cousin.

² Presumably Erasmus Alvey Darwin, Darwin's elder brother.

³ William Darwin Fox. Personal communication.

⁴ *Idem*.

⁵ *Idem*.

form of body gained in one generation, so it is impossible to transmit them, & as offspring must be like parent, therefore mule has no offspring & therefore no generative organ.

Same Prop. better enunciated. — An animal in either parent cannot transmit to its offspring any change from the form which it inherits from its parents stock without it be small & slowly attained. N.B. The longer a thing is in the blood the more persistent any amount of change & shorter time less so. The result of this is that animal would endeavour to return to parent stock, but if both parents are alike, offspring must be like. |

- 18 Hence mutilations not hereditary, but size of particular muscles. — When two animals cross, each sends his own likeness & the union makes hybrid, in fact the parents beget child like themselves. expression of countenances, organic diseases, mental disposition, stature, are slowly obtained & hereditary; if the change be congenital (that is most slowly obtained with respect to that individual) it is more easily inherited, — but if change be in blood long, it becomes part of [the] animal, — by a succession of generations, these small changes become multiplied, & great
19 change be effected, but | in a mule these conditions are not fulfilled. My grandfathers¹ theory of mules not hereditary, because generation highest point of organization, false. — The creator would thus contradict his own law. So far is there any appearance of animals being created, it is probable if created at once, according to ordinary laws, the character of offspring would vary, or rather they would not have offspring. —

On the idea of generation being a bud from parent, if whole parent not entirely imbued with the change, a bud could not be taken, without it either went back, or not being perfect would perish. — |

- 20 The varieties of the domesticated animals must be most complicated, because they are partly local & then the local ones are taken to fresh country & breed confined to certain best individuals. — scarcely any breed but what some individuals are picked out, — in a really natural breed, not one is picked out, & few even of local varieties approaches quite to wild local variety. our European varieties must be very unnatural. — Italian Greyhound is probably the effect of local variety many times
21 changed | together with some training in the earlier branches as in common greyhound² & much intermarriage. —

In my speculations, must not go back to first stock of all animals, but merely to classes where types exist, for if so, it will be necessary to show how the first eye is formed, — how one nerve becomes sensitive to light, (Mem. whole plant may be considered as one large eye — have they smell, do plants emit odour solely for other parts of creation) & another nerve to finest vibration of sound, which is impossible. — |

- 22 Mr Spence² remarks that the *Fringilla domestica* of North Europe is replaced by

¹ Erasmus Darwin. *Zoonomia*, London 1794, vol. 1, p. 513 :—"mules which evidently partake of both parents, but principally of the male parent".

² William B. Spence. "Observations on a mode practised in Italy of excluding the Common House-fly from Apartments", *Trans. Entom. Soc. Lond.*, 1836, vol. 1, p. 1. On p. 6 :—"it would also be desirable to have similar experiments made as to the house-flies of America and other hot countries, in which it is probable that in the same way as our common sparrow (*Fringilla domestica*, Linn.) is replaced in Italy by another species (*F. cisalpina*, Temm.), which to an ordinary observer seems identical with ours, but is really distinct, . . . "

the *F. cisalpina* in Italy which is so like that difference would not be discovered by an unscientific observer. — Transactions of the Entomological Soc.

A capital passage might be made from comparison of man, with expression of monkey when offended, who loves who fears who is curious &c. &c. &c. who imitates. — who will say there is distinct creation required if he believe Hyaena & squirrel seal & mouse elephant, come from one stock. — |

23 *Theory of Geograph. Distrib.: of organic beings.* —

Animals of same classes differ in different countries in exact proportion to the time they have been separated; together with physical differences of country: the time of separation depends on facility of transport in the species itself, & in the local circumstances of the two countries in times present & past. The effect of physical conditions of country is not perhaps so great, as separation or interbreeding, for otherwise we could not understand the vast number | of domesticated races. —

Athenaeum, ¹ p. 505, some (very poor account) of plants of Nova Zembla in review of Baers work.

Edinburgh Royal Transact.² — p. 297, vol. 9, Dr Ferguson seems most clear that the ideosyncrasy of the Negro (& partly mulatto) prevents his taking any form of Malaria — Adaptation & species-like. — Says Negro thick skinned.

My hairdresser (Willis)³ says that strength of hair goes with colour, black being strongest. |

25 V p. 63. Note Book *M*¹ for case of change in food in insects entered by mistake.⁴ Surely the fossil Mammalogy of Britain & Europe is African, & the only difference is by the *extinction* of certain forms from northern part & not by fresh creation of new forms. — What is range of Hyaena? Hippopotamus? Indio-African, or Pure Africa? — Fossil Elephant of Africa most important under this view, & Hippo[po]tamus of Madagascar: because contemporaries.

In introduction to Eytons⁵ Anatidae — recurs to idea of only animals from distant countries breeding! mem. 3 species of goose Has not goldfinch & greenfinch bred, & surely wild duck & pintail & widgeon! — Divides world into zoological Provinces, animals according to varieties of man. ?Will it hold good. — Thinks Temminck⁶ doubtful when he says no genera. — In Australia plants E & W very different, — man not so but N. & S. New Zealand, New Caledonia two races of man
26 but not plants. thinks | there are some small divisions. — does not seem to think

¹ Karl Ernst von Baer. Review of "Expedition to Novaia Zemlia and Lapland" (St. Petersburg Bull Sci., III, 1838), *Athenaeum*, 1838, July 21, p. 505.

² William Ferguson. "On the Nature and History of the Marsh Poison", *Trans. Roy. Soc. Edinb.*, (read Jan. 3, 1820) 1823, vol. 9, p. 273. On p. 297 there is a note "On the Negro Skin": "... From peculiarity of idiosyncrasy, he appears to be proof against endemic fevers; ... One of the most obvious peculiarities of the Negro, compared with the European, is the texture of his skin, which is thick, oily ... " cf. recent research on the immunity against malaria conferred by sickle trait, A. C. Allison: "Human Haemoglobin types", *New Biology*, 21, 1956, p. 43. (Penguin Books).

³ Mr. Willis. Hairdresser. cf. below MS. p. 163.

⁴ The reference is to Darwin's First Notebook on Metaphysics, Morals & Speculations on Expression (Cambridge University Library, Darwin MS. 125) begun 15th July 1838, finished 2nd October 1838, from which p. 63 was excised by Darwin on 16th December 1856.

⁵ Thomas Campbell Eyton. *A Monograph on the Anatidae*, London, 1838, p. 1:—"... that those animals upon which this experiment has been tried have invariably been brought from countries far apart, ..."

⁶ Coenraad Jacob Temminck. Presumably *Observations sur la classification méthodique des oiseaux*, Amsterdam & Paris 1817.

any improbability to animals being distributed after *flood* (!) according to affinities! confounds, *like Whewell*,¹ affinity with analogy. — Good table at end of distrib.: of Anatidae. — Consult this book again. —

Mine is a bold theory, which attempts to explain, or asserts to be explicable every instinct in animals.

Heard at Zoolog. Soc. that Pintail & Common Ducks, breed one with another — & hybrids fertile inter se (No) directly against Eyton's rule.² ?Are the hybrids similar inter se — |

27-34 *excised*.

35 Owen³ says relation of Osteology of birds to Reptiles shown in osteology of young Ostrich.

16th [Aug.] D Israeli⁴ (Cur. of Literat. vol. II, p. 11) accidentally says " — is distinctly marked as whole dynasties have been featured by the Austrian lip & the Bourbon nose", if this be not imagination, then old peculiarity overbears the crossing with females not thus characterized. — |

36 16th Aug. What a magnificent view one can take of the world Astronomical causes modified by unknown ones, cause changes in geography & changes of climate suspended to change of climate from physical causes, — then suspended changes of form in the organic world, as adaptation, & these changing affect each other, & their bodies by certain laws of harmony keep perfect in these themselves. — instincts alter, reason is formed & the world peopled with myriads of distinct forms from a period short of eternity to the present time, to the future. — How far grander than
37 idea from cramped | imagination that God created (warring against those very laws he established in all organic nature) the Rhinoceros of Java & Sumatra,⁵ that since the time of the Silurian he has made a long succession of vile molluscos animals. How beneath the dignity of him, who is supposed to have said let there be light & there was light. — whom it has been declared " he said let there be light & there was light " — bad taste.

August 19th Two regions may be Zool.-geographically divided either by development of new forms in one, or apparently so by the extinction of prominent ones in one: The latter will take place when conditions are unfavourable to numbers of
38 animals as in changing from warm to | cold, damp to dry. — Thus Tierra del Fuego has only one Guanaco of this characteristic form of S. America.

With respect to future destinies of mankind, some of [the] species or varieties are becoming extinct, others though the negro of Africa is not loosing ground, yet, as the tribes of the interior are pushing into each other from slave trade & colonization of S. Africa, so must the tribes become blended & prevent the strong separation
39 which | otherwise would have taken place otherwise in 10,000 years. Negro probably

¹ William Whewell, author of *History of the Inductive Sciences*, London 1837.

² Thomas Campbell Eyton. "Some remarks upon the theory of Hybridity", *Mag. Nat. Hist.*, 1837, vol. 1, p. 357.

³ Richard Owen. "On the anatomy of the Southern Apteryx (*Apteryx australis*, Shaw)." Communicated 10th April 1838. *Trans. Zool. Soc. Lond.*, vol. 2, 1836-1841, p. 257. On page 189:—"The close resemblance of the Bird to the Reptile in its skeleton is well exemplified in the young Ostrich, . . ."

⁴ Isaac Disraeli. *Curiosities of Literature*.

⁵ cf. Darwin's *Sketch* of 1842 and his *Essay* of 1844; in *Evolution by Natural Selection* with a Foreword by Sir Gavin de Beer, Cambridge 1958, pp. 83 and 249.

a distinct species — We know how long a mammal may go on as one species from Egyptian mummies & from the existing animals found fossil when Europe must have worn a quite different figure.

19th [Aug.] With respect to the Deluge, it may be worth adding in note that amongst the Mammalia of Europe the shells of ditto — shells of N. America — shells of S. America, — there is no appearance of sudden termination of existence, — nor is there in the Tertiary geological epochs. — |

40 There are some admirable tables on geograph distribution of reptiles in Suites de Buffon.¹ —

Vigors² has given list in Linnean Transactions of birds of Java — Caterpillars not being fertile is same as children not being so. — consider this with reference to “new species & hybrid doctrine”. — I have read there are exceptions to this in some larvae of insects. (?glowworm) breeding — imago state fertile at once. — Consider this with reference to those insects which have fertile offspring. Entomostraca & Aphides. |

41 The extreme difference of sexes is probably arrived at wing case of insects as glowworm.

The case of one impregnation sufficing to several births analogous to superfoetation, & the successive fertile offspring in Entomostraca & Aphides. Developement of sexes in caterpillars, very valuable facts — they are eating foetuses, as young of Marsup. is sucking foetus. —

August 23rd The Rev. R. Jones³ gave an admirable harrier from Ireland to Brighton
42 Pack — *first rate* bitch — tried to breed from her, but | her offspring came out one big & one small. Now Jones, before this happened from her looks thought she was half bred Beagle & Staghound. the grandchildren went back to either parent & breed not fixed, though she resembled a harrier & her husband was pure harrier.

Three gentlemen of parts all thought with pigs &c, that hybrids were uncertain. The peculiarities of our breeds must have been acquired, & hence this is true case of avitism.

Mr Drinkwater⁴ thought that a “first blood” animal must have gone on for many years, before deserves to be so called, — the short horned cattle have gone on for
43 50 or 70? years, — now well fixed breed : Jones⁵ says Sussex cattle | were all white headed, but this was bred out & now all are pure red, yet calf every now & then born with white head (or short-horned with black lip) & then calf in both cases is killed.

Notes from *Glen Roy* Note Book.⁶

Why is not Tetrao Scoticus an American form (if so)? —

F. M. Daudin. *Histoire naturelle, générale et particulière des reptiles ; ouvrage faisant suite aux Oeuvres de Leclerc de Buffon*. Paris an XII [1805].

² Nicolas Aylward Vigors [& Thomas Horsfield.] “A description of the Australian birds in the collection of the Linnean Society ; with an Attempt at arranging them according to their natural Affinities.” *Trans. Linn. Soc. Lond.* vol. 15 Part 2, 1837, p. 170. This paper contains no list of Javanese birds, but on p. 331 there is a statement that “These two species very closely accord with the Javanese species of *Pomatorhinus*, *P. montanus*, described in these Transactions.”

³ Rev. R. Jones. Unidentified.

⁴ Drinkwater. Unidentified.

⁵ Rev. R. Jones. *Idem*.

⁶ Darwin visited Glen Roy at the end of June and beginning of July 1838. (“Darwin’s Journal”, edited by Sir Gavin de Beer, *Brit. Mus. (Nat. Hist.)*, Historical Series, vol. 2, London 1959, p. 8.)

A Shepherd of Glen Tunet said he learnt to know lambs, because in their faces they were most like their mothers, believe this resemblance general. ?depend upon mother being oldest breed? —

Quarterly Journal of Agriculture¹ p. 367, Dec. 1837. *Generally* received. |

- 44 Opinion that male impresses offspring more than female, yet instances given on opposite side. —

The theory of males impressing most is in harmony with their wars & rivalry. — The very many breeds of animals in Britain shows, with the aid of *seclusion* in breeding how easy races or varieties are made. —

The Highland Shepherd dogs coloured like Magellanic Fox, — peculiar hair & appearance — good case of Provincial Breed — Highland Sheep jet black legs, & face & tail, just like spencer² [?] high active breeding |

- 45-48 *excised*.

- 49 L'Institut³ p. 249 (1838). Eggs discovered to Taenia, — hard so as to resist external influence.

27th August. There must be some law that whatever organization an animal has, it tends to multiply & *improve* on it. — Articulate animals must articulate, & in vertebrate tendency to improve in intellect, — if generation is condensation of change, then animals must tend to improve. — Yet fish same as, or lower than in old days: for a very old variety will be harder to vary & therefore more apt to be extinguished. — ???

Mayo⁴ (Philosoph. of Living) quotes Whewell⁵ as profound because he says length of days adapted to duration of sleep of man!!! whole universe so adapted!!! & not man to Planets. — instance of arrogancell |

- 50 August 29th. — Macleay⁶ in A. Smith Zoolog. — of Africa. —

¹ *Quarterly Journal of Agriculture*, Edinburgh 1837, vol. 8, p. 367:—" . . . According to the generally received opinion, that the male imprints his characters more indelibly than the female on the progeny, there may be a risk of breeding from too large a horse for the usual purposes of the farm; but, on the other hand, it is frequently seen that small stallions and bulls produce large stock. . . . " Probably by one of the editors.

² Lord Spencer. *Journ. Roy. Agr. Soc.*, vol. 1, p. 24:—" It is therefore very desirable, before any man commences to breed either cattle or sheep, that he should make up his mind to the shape and qualities he wishes to obtain, and steadily pursue this object." cf. *Variation of Animals and Plants under Domestication*, London 1868, vol. 2, p. 195.

³ Félix Dujardin. *L'Institut*, 1838, 2 août, p. 249:—" . . . les oeufs de Taenia protégés par une coque très résistante peuvent résister aux causes extérieures de destruction . . . "

⁴ Herbert Mayo. *The Philosophy of Living*, London 1838, p. 136, Chapter III, "Of Sleep".

⁵ William Whewell. "The Length of the Day", *The Bridgewater Treatises on the Power Wisdom and Goodness of God as manifested in the Creation*, Treatise III, On Astronomy and General Physics, p. 38. On p. 39:—" . . . Man, in like manner, in all nations and ages, takes his principal rest once in twenty-four hours; and the regularity of this practice seems most suitable to his health, though the duration of the time allotted to repose is extremely different in different cases. So far as we can judge, this period is of a length beneficial to the human frame, independent of the effect of external agents. In the voyages recently made into the high northern latitudes, where the sun did not rise for three months, the crews of ships were made to adhere, with the utmost punctuality to the habit of retiring to rest at nine, and rising a quarter before six; and they enjoyed, under circumstances apparently the most trying, a state of salubrity quite remarkable. This shows, that according to the common constitution of such men, the cycle of twenty-four hours is very commodious, though not imposed on them by external circumstances.

"The hours of food and repose are capable of such wide modifications in animals, and above all in man, by the influence of external stimulants and internal emotions, that it is not easy to distinguish what portion of the tendency to such alterations depends on original constitution. . . . "

⁶ William Sharp Macleay. "Annulosa" in Andrew Smith: *Illustrations of the Zoology of South Africa*; . . . London, 1838.

p. 4. sticks¹ to genus or group of any kind not being perfect till circular.

p. 5 Most clearly shows² that genus expresses as now used almost any group. — all groups *natural* (p. 6) as expressing *natural* affinities. Macleays plan of arrangement depends on the organs judged to be of importance in inverse ratio to their variability. — (Now *ceteris paribus* these will be the oldest.) “The most important characters break down in certain species & become worthless³” — *Mammalia Edentata*. We do (p. 6) say⁴ such is group because it has such characters of importance, “but we say such happens to be the character, of no matter of what importance, which prevails throughout the group & serves to insulate it”. — i.e. what characters |
51 chance to be hereditary whether important or not.

p. 7. “The natural arrangement of animals themselves is the question in point”.⁵ Now what is *natural arrangement*, — affinities, what is that, amount of resemblance, — how can we estimate this amount, when no scale of value of difference is or can be settled. — I believe *affinity* may be taken literally, though how far we can ever discover the real relationship is doubtful, — not till much knowledge is elicited. — It will rest upon the discovery what characters *vary* most easily, — those which do not vary being foundation for chief divisions. —

p. 7. In some cases the circular arrangement from fewness of forms, cannot be discovered untill we descend to subgenera & families,⁶ in the *Cetoniadae*, — when will *Ornithorhynchus* come in circle?!!! |

52 p. 8 — Anomalous structures, as in *Hippo[po]tamus*, solely owing to number of lost links, if all species know[n] they would be innumerable⁷ — does not know any difference between *permanent variety* & *species* !!⁸ (given in note) — Macleay uses term *genus* when it is so many steps from a head as subkingdom — evidently artificial, as interlopement of marsupials will change all, — & so on no one will settle *number*

¹ *Ibid.* p. 4 :—“ *Omnis sectio naturalis circulum, per se clausum exhibet.*”

² *Ibid.* p. 5 :—“ . . . has the word *genus* any signification which is universally deemed definite? ”

³ *Ibid.* p. 6 :—“ . . . the most important characters break down in certain species, and become at times perfectly worthless . . . ”

⁴ *Ibid.* pp. 6–7 :—“ . . . We do not argue that such must be the groupe, because such and such are in our opinion, good and distinct characters ; but we say, such happens to be the character, of no matter what importance, which prevails throughout the groupe, and which serves in some degree to insulate it from other groupes. . . . ”

⁵ *Ibid.* p. 7 :—“ . . . we ought not to forget that the true question under consideration is, the natural arrangement of the animals themselves ; . . . ”

⁶ *Ibid.* p. 7 :—“ . . . for owing to the rarity of its species, the first circular grouping of the species *Cryptodinus*, for instance, is into sub-genera ; . . . ”

⁷ *Ibid.* p. 8 :—“ Thus, when the naturalist talks of any anomalous structure, I understand merely that so many links, that is so many groupes, of the great plan of creation are wanting, . . . If I say that the *Hippopotamus* forms a stirps by itself, I only mean that it is the sole species of its stirps known ; and that, speaking theoretically, four families are wanting, . . . or rather twenty-four genera to connect it well with other tribes of *Pachyderms* . . . ”

⁸ *Ibid.* p. 8 footnote :—“ Some persons have imagined that I only assign five species to the lowest groupe in nature ; but the above theory evidently proceeds on the assumption that if we knew *all* the species of the creation, their number would be infinite, or in other words, that they would pass into each other by infinitely small differences. This actually takes place sometimes in nature ; and as yet I do not know any good distinction between a species and what is called ‘ a permanent variety ’.” cf. William Herbert : *Amaryllidaceae*, London 1837, p. 29 :—“ That in some genera intermediate diversities from different localities so confound the limits of species that it is waste of words to argue whether a plant is a species or a permanent local variety ; . . . ”

of primary divisions. — Complains¹ (p. 53) of M. Edwardes² thinking any group good, though not circular, if characters can be established — clearly so. — N.B. — This paper worth referring to again. — According to my theory, every species in any subgenus will be descended from one stock, & that stock with other subgenera |

53-56 excised.

57 Foetus of man undergoes metamorphosis, heart altered & umbilical cord. — Broderip³ alluded to Hunter's views⁴ on this subject. — Monstrosities kind of determined by *age* of foetus. —

As Larva may be more perfect (as we use the word) than parent, so may species retrograde, but these facts are rare. —

2^d Sept. Those animals which have many *abortive* organs might be expected to have larva more perfect — this is applicable to young of Cochineal ?? |

58 Is there some law in nature an animal may acquire organs, but lose them with more difficulty — contradicted by abortive organs but number of species with abortive organs of any *kind* few, — hence become *extinct*, & hence the *improvements* of every type of organization. Such law would explain every thing. — *Pure hypothesis* be careful. —

Argument for circularity of groups. When a group of species is made, father probably will be dead — hence there is no central radiating point, all united, (like an uncle must be granted unequal, because fossil) now what is group without centre
59 but circle, two or three | lines deep — with respect to Macleay's⁵ theory of analogies — when it is considered the tree of life must be erect not pressed on paper, to study the corresponding points.

The present geographical distribution of animals countenances the belief of their extreme antiquity (i.e. much intervening physical change) — distribution especially of Mammalia.

As every organ is modified by use, every *abortive* organ must have been once changed. — What is abortive? when it does not perform that function which *experience* shows us it was for. — Most important law. — Penguins wing perhaps not abortive ??? Apteryx certainly. — |

60 Lyell's⁶ excellent view of geology of each formation being merely a page torn out of a history & the geologist being obliged to fill up the gaps, — is possibly the

¹ *Ibid.* p. 53 :—" M. Milne Edwards . . . produced a classification, of which I can only say, that it makes an approach to be a rare exception to the well-known fact, that professed comparative anatomists are the persons, of all others, who in general are most incapable of using their own observations for purposes of natural arrangement. And indeed this very arrangement of Edwards is not natural, since he unfortunately conceives that every groupe he can invent, provided he can furnish it with a character, must therefore be a good one."

² Henri Milne Edwards. *Histoire naturelle des Crustacés*, Paris 1834-40, vols. 3 & Atlas (forming one of Roret's "Collection des Suites à Buffon").

³ William John Broderip. Presumably personal communication.

⁴ John Hunter in Richard Owen: *Descriptive and Illustrated Catalogue of the physiological series of Comparative Anatomy contained in the Museum of the Royal College of Surgeons in London*, London 1833, vol. i, p. iv, footnote: "I should imagine that monsters were formed monsters at the very first formation, for this reason, that all supernumerary parts are joined by their similar parts, viz. a head to a head &c. &c." Hunterian MSS."

⁵ William Sharp Macleay. *Horae Entomologicae*, London 1819-21, p. 391.

⁶ Charles Lyell. *Elements of Geology*, London 1838, p. 272 :—" . . . of a series of sedimentary formations, they are like volumes of history, in which each writer has recorded the annals of his own times, and then laid down the book, with the last written page uppermost . . . "

same with the philosopher who has traced the structure of animals & plants. — He get[s] merely a few pages.

Hence (p. 59) looking at animal, if there be many others somewhat allied whether like parent stock, or not, now wings for flight — therefore ostrich not. The peculiar Malacca bears belong to same section with those of India. |

61–64 excised.

65 man have carries the range — Argue the case of probability, has Creator made rat for Ascension — The Galapagos mouse probably transported like the New Zealand one — It should be observed with what facility mice attach themselves to man.

Sept 7th. I was struck looking at the Indian cattle with Bump, together with Bison of some resemblance as if the “*variation* in one was analogous to specific character of other species in genus”. — Is there any law of this. Do any varieties

66 of sheep evidently artificial approach | in character to goats, — or dogs to foxes¹ (yes Australian dog) or donkeys to zebras. — Mr. Herberts variety of horse, dun coloured with stripe approaches to ass, or fowls to the several aboriginal species or ducks (here argue if it be said domestic fowls are descended from several stock[s] then species are fertile ; as long as opponents are² not able to tie themselves down, they can find loopholes) “It is well worthy of examination whether variations are produced only in those characters which are seen to be different in species of same genus”.

67 Law of monstrosity not prospective, but retrospective in showing | what organs are little fixed — (Hunters³ law of monstrosity with regard to age of foetus distinct consideration). Now in different species of genus *Sus*, see Cuvier⁴ *Ossemens fossiles*, do vertebrae vary? Although no new fact be elicited by these speculations even if partly true they are of the greatest service towards the end of science, namely prediction, till facts are grouped & called there can be no prediction. — The only advantage of discovering laws is to foretell what will happen & to see bearing of scattered facts. — |

68 What takes place in the formation of a bud — the very same must take place in copulation — (man & woman separate parts of same plant) — now in some Polypi we see young bud changing into ovules. —

Captain Grants⁵ Himalaya shells (see Paper in Geolog Transact) same appearance with secondary species distinct but close. — Mem. Von Buch⁶ on Cordillera fossils same remark. ? Was then formerly one great sea, & two Polar Continents. Marsupial, Edentata, Pachydermata &c. &c. — |

¹ William Herbert. *Amaryllidaceae*, London 1837. On p. 339 :—“ . . . I have lately had under my observation a dog, whose father was a fox in an innyard at Ripon, and it has singularly the manner as well as the voice of a fox, but it is the parent of many families of puppies : and I feel satisfied that the fox and the dog are of one origin, and suspect the wolf and jackall to be of the same ; nor could I ever contemplate the black line down the back of a dun pony without entertaining a suspicion that the horse, unknown in a wild state except where it has escaped from domesticity, may be a magnificent improvement of the wild ass in the very earliest age of the world : . . . ”

² Altered in MS. from “will not tie themselves down.”

³ John Hunter in Richard Owen : *Descriptive and Illustrated Catalogue of the physiological series of Comparative Anatomy contained in the Museum of the Royal College of Surgeons in London*, London 1833, vol. 1, p. iv, footnote. See above, footnote to MS. p. 57.

⁴ Georges Cuvier. *Recherches sur les Ossemens Fossiles des Quadrupèdes*, . . . Paris 1812.

⁵ Captain C. W. Grant. Presumably “Memoirs to illustrate a geological map of Cutch”, read 22nd February 1837, *Trans. Geol. Soc. Lond.*, 1840, vol. 4, p. 289.

⁶ Leopold von Buch. “Ueber den zoologischen Charakter der Secundär-Formationen in Süd Amerika”, *Monatssch. K. pr. Akad. Wissensch.*, Berlin, 1838, p. 54. (*Gesammelte Schriften*, Berlin 1885, Band 4, p. 497.

- 69 It is important with respect to extinction of species, the capability of only small amount of change at any one time.

Seeing what Von Buch¹ (Humboldt)² G. St. Hilaire,³ & Lamarck⁴ have written I pretend to no originality of idea — (though I arrived at them quite independently & have used them since) the line of proof & reducing facts to law only merit if merit there be in following work. —

The history of medicine, the extraordinary effects of different medium on organs leads one to suspect any amount of change from eating different kinds of food. Grazing animals which eat every species new. — |

- 70 Sept. 8th A Golden Pippin or Ribstone ditto producing occasionally (as Fox⁵ says) same fruit trees is analogous to some hybrids breeding — there is tendency to reproduce in each case, but something prevents the completion. —

Say my grandfathers⁶ expression of generat[ion] being highest end of organization *good expression* but does not include so many facts as mine. |

- 71 The facts about half bred animals being wilder than parents is very curious as pointing out difference between acquired & hereditary tameness. —

In comparing my theory with any other, it should be observed not what comparative difficulties (as long as not overwhelming) [but] what comparative solutions & linking of facts.

Savages over whole world (Major Mitchell⁷ p. 244, vol. I) spit & throw dust. According to my theory of generation (p. 175) of⁸ |

- 72 Yarrell⁹ told me he had just heard of Black game & Ptarmigan having crossed in wild state — & the English & some African Dove. — The extinction of the S. American quadrupeds is difficulty on any theory — without God is supposed to create & destroy without rule. But what does he in this world without rule? The destruction of the great Mammals over whole world shows there is rule. — S. America & Australia appear to have suffered most with respect to extinction of larger forms. —

From observing way the Marsupials of Australia have branched out into orders one is strongly tempted to believe one or two were landed |

- 73-74 excised.

¹ Leopold von Buch. *Description physique des îles Canaries*, Paris, 1836, p. 144. (cf. Darwin's First Notebook MS. p. 156); *Ibid.* p. 148, (cf. Darwin's First Notebook MS. p. 158).

² Friedrich Heinrich Alexander von Humboldt. *Personal Narrative of Travels to the Equinoctial Regions of the New Continent, during the years 1799-1804*, London 1821, vol. 5, p. 565. (cf. Darwin's First Notebook MS. p. 142).

Ejusdem. *De Distributione geographica plantarum secundum coeli temperiem et altitudinem montium, prolegomena*. Lutetiae Parisiorum 1817 (cf. Darwin's First Notebook MS. p. 156).

³ Etienne Geoffroy-Saint-Hilaire. *Principes de philosophie zoologique*, Paris 1830. (cf. Darwin's First Notebook MS. *passim*.)

⁴ Jean-Baptiste de Lamarck. *Philosophie Zoologique*, Paris 1809. *Histoire naturelle des animaux sans vertèbres*, 1815, Paris (cf. Darwin's First Notebook *passim*.)

Ejusdem. *Hydrogéologie, ou recherches sur l'influence générale des eaux sur la surface du globe terrestre, sur les causes de l'existence du bassin des mers, de son déplacement, de son transport successif sur les différents points de ce globe, enfin sur les changements que les corps organisés vivants exercent sur la nature et l'état de cette surface*, Paris 1802. (cf. Darwin's Second Notebook MS. p. 119.)

⁵ William Darwin Fox. Probably personal communication.

⁶ Erasmus Darwin. *Zoonomia*, vol. 1, London 1794, Section XXXIX.

⁷ Thomas Livingstone Mitchell. *Three Expeditions into the Interior of Eastern Australia*, . . . London 1838, vol. 1, pp. 244, 245.

⁸ These words were crossed out in MS.; they refer to MS. p. 175 below.

⁹ William Yarrell. Personal communication.

75 Mitchell¹ Australia vol. I, p. 306 "The crows were amazingly bold, *always accompanying us from camp to camp*; it was absolutely necessary to watch our meat, while in kettles on the fire, & on one occasion, notwithstanding our vigilance a piece of pork 3 lb was taken from a boiling pot, & carried off by one of these birds". Case of birds of different family having very same habits in some respects as the Cara cara. |

76 Sept. 9th It is worthy of observation that in insects where one of the sexes is little developed, it is always female which approaches in character to the larva, or less developed state. —

The female & young of all birds resemble each other in plumage. — (That is where the female differs from the male?) children & women — "women recognized inferior intellectually". Opposed to these facts are effects of castration on males & of age or castration in females. — |

77-90 excised.

91 This keeper has seen when sickly tigers have first come over, insects somewhat like between lice & fleas, sticking on them, — but never in an animal, that had long been in confinement — is this effect of climate, or state in which they are kept? —

Is there any mistake about Yarrell's law,² is it *local* (not *artificial* variation) which impresses offspring most & *not time* thinking of the Penguin duck & Herbert's law of ideosyncrasy³. |

92 I have hitherto thought that a small difference of any kind, if very firmly fixed from long time, made no difference what its kind was, — but if it were *opposed* to the difference in other sex, it would be much more difficult to propagate — as if one bird had very bright red breast & other very bright blue, it might be harder for |

93 both parents to transmit their peculiarities, that if both had mottled breasts, of a sort that would allow the offspring to have some different kind of mottle, each feather partaking of character of other, — the *most* aquatic & most terrestrial species, might be harder to cross than two less opposed in habits, though externally similar. — this

94 however is a sophism for | their brain or stomach would be different. — Or if one species left its type in having very long legs, & another in having very long tail, & other in having very *short* tail. — I can readily see that two first might cross easier than two last. |

95-98 excised.

99 September 13th. The passion of the doe to the victorious stag, who rubs the skin of [f] horns to fight, is analogous to the love of women (as Mitchell remarks⁴ seen in savages) to brave men. —

Effect of castration horns drop off, replaced by hairy ones, which never dry up & peel off their skin (not being wanted for war) & hence never fall off. Curious the rapidity of the change in 5 or 6 weeks after castration, fresh horns begin to grow.

¹ Thomas Livingstone Mitchell. *op. cit.*, vol. I, p. 306.

² William Yarrell. cf. Darwin's Second Notebook on Transmutation of Species, MS. pp. 1 & 121 (The supposition that the oldest variety has the greatest effect on offspring when crossed).

³ William Herbert. *Amaryllidaceae*, London 1837. On p. 343 :—"In further confirmation of the fact that the sterility depends on constitutional discrepancy, or difference of what medical men call idiosyncrasy, . . ."

⁴ Thomas Livingstone Mitchell. *op. cit.*, vol. I, p. 304 :—" . . . the gins have it in their power on such occasions to evince that universal characteristic of the fair, a partiality for the brave."

— Mr Yarrell¹ says the male Axis of India, breeds at times when horns not perfect — (is not this so in S. America with *C. campestris*, refer to my notes) & Mr Yarrell supposes this a consequence of that female breeding all the year round. Ask Colonel Sykes². |

100 Even our domesticated cattle have *tendency* to breed at particular times.

Mr Yarrell has old book 1765? *Treatise on Domestic Pidgeon*,³ in which it appears that all the varieties now known were then existing. — he has also some very fine recent drawing of prize pidgeons in 1834. — now this would be most curious to show that in sixty years (how many generations) the strangest peculiarities have been kept perfect — also to trace the laws of change in this time. — The impossibility of discovering their origin. — I see only some, but very strange races of them have the forked black mark of the Rock Pidgeon, — several have a group |

101-106 excised.

107 which it must have taken to separate Van Diemens Land from Australia &c. &c.

September 14th. When Macleay⁴ says there is no difference between "permanent varieties" & species, he overlooks those restricted in their range by man & by art — the former only giving average of effects of country (& no monstrosity or adaptations to unhealthy state of womb). —

One can perceive that natural varieties or species, all the structure of which is adaptation to habits (& habit second nature) may be more in constitutional,—more conformable to the structure which has been adapted to former changes than a mere monstrosity propagated by art. |

108 Yarrell⁵ told me of a cat & of a dog born without front legs — the former of which had kittens with imperfect ones, — now Sir J. Sebright⁶ thought if he had had a pair he could have produced from them — this instance of monstrous variety which could not have been persistent in nature. —

According to my view, the domesticated animals would cease being fertile inter se, or at least show repugnance to breeding if instincts unchanged, & if their characteristic qualities were all deeply imbued in them from long permanence, so that all their peculiarities must be transmitted if their |

109-110 excised.

III every case common to many good species, & therefore to genera (& the uncles & aunts) & therefore does not tell against transmutation of species — will it against genera. — How long will the wretched inhabitants of N.W. Australia go on blinking their eyes without extermination, & change of structure. — When will the mosquitoes of S. America take an effect — would perfect impunity from moskitoes bite influence propagation of species. —

¹ William Yarrell. Personal communication.

² Col. William Henry Sykes, author of the "Catalogue of Mammalia of Dukhan", *Proc. Zool. Soc. Lond.*, 1831, vol. 1, p. 95 :—cf. *Variation of Plants and Animals under Domestication*, 1868, vol. 1, p. 62.

³ The book referred to is probably *A Treatise on Domestic Pigeons, comprehending all the different species known in England* . . . to which is added a . . . description of that celebrated . . . pigeon called the Almond Tumbler, London 1765.

⁴ William Sharp Macleay. "Annulosa" in A. Smith: *Illustrations of the Zoology of South Africa*, London 1838, p. 8, footnote. (cf. footnote to MS. p. 52 above.)

⁵ William Yarrell. Personal communication.

⁶ Sir John Sebright. Probably personal communication.

Case of association very disagreeable hearing maid servant cleaning door outside as often as she touched handle, though really fully aware she was not coming in, — could not help being perfectly disturbed, referred to Book M.¹ |

- 112 Is there any *law of variation* (as Hunter² supposes with *monsters*) — if armless cat can propagate, i.e. with the chance of two being born at same time, & make breed, one would doubt any law. — yet seeing the feathers along one toe of the Pouter one thinks there is a law, — that there must have been a tendency for feathers to grow there. That mutilations will not alter form may be inferred from Australian knocking out teeth. — The account of the people on the N.W. Coast blinking to keep out flies might be used.

The wild ass has no *cross*, how comes it that the tame donkey has. Old Buffon³ should be read on mare.

My view why hybrids are infertile, supposes that when foetus is forming the ovum within it is forming & this must be so else avitism could hardly ever occur. — and if that cannot be formed, generat. organ by that co-relation of parts will not be produced. — |

113-114 excised.

- 115 p. 482 (same book, Hunter Animal Economy) Owen says⁴ “ the necessity of combining observation of the living habits of animals, with anatomical & zoological research, in order to establish entirely their place in nature, as well as fully to understand their oeconomy, is now universally admitted ”. — p. 483 Owen⁵ thinks from climate of Australia & from Ornithorhynchus & Hydromys not being Marsupial (but *also mice*) & there being water animals these structures “ may have reference to the great distances which the mammalia of N.S. Wales are generally compelled to traverse in order to quench their thirst ” — But *New Guinea*!! S. America. — Such difficulties will always occur if animals are thought to have been created. — it might as well be attempted to be shown from peculiarities of climate cause of N. Zealand not having any Mammalia. — Type of geographical organization. No more can be said |

- 116 In paper on bees in same work it is said⁶ that some kinds lay up honey even for single rainy day — & from case of wasps is supposed cells properly are made for larvae. — (p. 451) — Wasps breed many females, but almost all die — bees breed but few, because they are kept in security. — Hunter doubts about production of Queens. — Neuters are bred first, then males — how has this been arranged — Neuters are true female, but with parts little developed. —

- 117 Sept. 19th There is no scale according to importance of divisions in arrangement, of the perfection of | their separation. — Thus Vertebrata blend with Annelida by some fish. — But birds quite distinct. —

¹ The reference is to Darwin's First Notebook on Metaphysics, Morals and Expression.

² John Hunter in Richard Owen: *Descriptive and Illustrated Catalogue of the physiological series of Comparative Anatomy contained in the Museum of the Royal College of Surgeons in London*, London 1833, vol. 1, p. iv.

³ Georges-Louis Leclerc, Comte de Buffon. *Histoire naturelle. Quadrupèdes*, Paris.

⁴ Richard Owen in John Hunter: *Observations on certain parts of the Animal Oeconomy with Notes by Richard Owen*, London 1837, p. 482, footnote 1.

⁵ Richard Owen in John Hunter. *Ibid*, p. 483, footnote.

⁶ John Hunter. *Ibid*, p. 451, “ On the number of Queens in a hive ”.

Collect cases of difficulty of growing plants in all parts of world, thus tea trees in Brazil must have degenerated, as must spices &c &c.

The line of argument often pursued throughout my theory is to establish a point as a probability by induction, & to apply it as hypotheses to other points, & see whether it will solve them. — |

- 1118 It is less wonderful that child's nervous system should build up its body like its parent than that it should be provided with many contingencies how to act. — So with the mind the simplest transmission is direct instinct & afterwards enlarged powers to meet with contingency. —

Sept. 23rd. Saw in Loddiges¹ garden 1279 varieties of roses!!! proof of capability of variation. — Saw his collection of Humming birds, saw several greatly developed tails & one with beak turned up like Avocette. here is what |

1119-126 excised.

- 127 that it shall beget young different in colour, form, & so altered in disposition as to be more easily trained up to the offices'' &c. &c.

Owen illustrates² case of Dingo (he alludes to the Dholes or wild dogs of India) in Zoolog. Garden having coloured offspring — but surely in all these cases an unseen change is produced in parent — colour is a doubtful subject, but what other instances are there of such changes, *not* acquired by parent, being handed down? |

- 128 Are not Loddiges³ 1279 roses kept in same soil, same atmosphere? — may they not be transplanted?, & yet year after year, successive roses & bud are produced, like parent stock or if different deteriorating very slowly. — I presume most of these roses, without circumstances very unfavourable, will continue of same variety as long as life lasts, yet they cannot transmit through seeds these characters though transmitting them with such facility to bud. — This must be owing to their unity

- 129 in one stem. — | A bud may be transplanted & carry all these peculiarities — not so a seed. — Bud probably is like cutting off tail of Planaria, claw added to crab, tail to lizard, healing of wound. — reproductive faculty simplest forms of budding. Why does Gecko produce always different tail? The whole grown to that part — in the separated part every element of the living body is present, in generation something is added from one part of the body, (or of other similar, body) to another part of body. — (in plants does not whole individual change into generative organs?) it is of no consequence if it does — Do plants lose any qualities by being buds — more than if whole branch transplanted? |

- 130 An individual bud may be thus produced from the growth of one part, (not strictly new individual) or he may [be] produced by having undergone the endless changes which its parents have, — not this is effected by short method in *generation*. —

¹ Conrad Loddiges. *Catalogue of Plants in the Collection of Conrad Loddiges & Sons, Nurserymen at Hackney near London*. 13th edit. London 1823, p. 33 gives Rosa fl. simpl. 1205; 15th edit. London 1830, p. 57 gives Rosa fl. simpl. 1470. Presumably Darwin worked from the 14th edition.

² Richard Owen in John Hunter. *Op. cit.*, p. 330, footnote:—"The existence of wild dogs which are not wolves, as the Dingo of Australia and the Dhole of India, which have either lost or have never acquired the common character of domestication, variety of colour, it is itself a strong argument against the original of the domestic dog ever having been a wolf."

³ Conrad Loddiges. *op. cit.*

Ehrenberg¹ considers artificial division of animals as gemmation. I consider gemmation as artificial division. — On this view each particle of animal must have structure of whole comprehended in itself, — it must have the knowledge how to grow & therefore to repair wounds — but this has nothing to do with generation.

Why crab can produce claw but man not arm, hard to say. — |

- 131 if it were possible to *support* the arm of man,² when cut off, it would produce another man. — That the embryo the *thousandth* of inch should produce a Newton is often thought wonderful, it is part of same class of facts, that the skin grows over a wound. —

Does likeness of twin bear on the subject ?

A mans arm would produce arm if *supported*, & in making true bud some such process is effected, — a *child* might be so born, but it would be very different from true generation, — there is no caterpillar state : the vast difference of two kinds of generation shown by their happening in same plant. — |

- 132 The Marsupial structure shows that they became Mammalia, through a different series of changes from the placentalia. Having hair like true Mammalia, no more wonderful than Echidna & hedgehog having spines. —

Does not male pidgeon (yes surely) secrete milk ? from stomach, analogous to other males feeding young, & to abortive mammae in male Mammalia — ? is not this argument for mammalia recent creation. — why what tendency can there be for abortive organ ever disappearing ?? — Have Marsupiata abortive mammae ? —

My view would make every individual a spontaneous generation : what is animalcular semen but this — the living nerve massed in mould. — |

133-136 *excised*.

- 137 it, & made it meet in front. — Dr Smith³ every baboon & monkey, big & little that ever he saw knew women. — he has repeatedly seen them try to pull up petticoats, & if women not afraid, clasp them round waist & look into their faces & make the st. st noise. — The cercopithecus chinensis? (or bonnet faced) monkey he has seen do this. — These monkey[s] had no curiosity to pull up trousers of men. Evidently knew women, thinks perhaps by smell, — but monkeys examine sexes of every [animal]. |

- 138 Has repeatedly seen one he kept pull up feathers of tail of Hen, which lived with it, — also of dogs *but did not seem to evince more lewdness for bitch than dog* : monkeys thus examine each other sexes by taking up tail. — Mem.: Ourang Jerry with Tommy. — Good evidence of knowledge of woman. —

- The noise st st which the C[cercopithecus] sphingiola makes is also made by the C. porcarius, together with a grunting noise, the former signifies recognition with pleasure, as when food is offered, as much as to | say give me — the other when Dr Smith more distant. — But he thinks other monkeys make st. — noise. In case of woman instinctive desire may be said more definite than with bitch, for some

¹ Christian Gottfried Ehrenberg. *Athenaeum*, 1838, 8th Sept. p. 653. (8th Meeting of the Brit. Assoc. Adv. Sci., Section Zool.) " . . . believes that process of multiplication by division to be merely the development of a gemma or bud . . . "

² Darwin is using the expression " to support the arm of a man " in the sense of keeping it supplied with its physiological requirements. An anticipation of tissue culture by 70 years.

³ Dr. Andrew Smith. Personal communication.

feeling must urge them to these actions. These facts may be turned to ridicule, or may be thought disgusting, but to philosophic naturalist pregnant with interest.

Hyaena, thinks, when pleased cocks his ears, when frightened depresses them.

England was united to Continent when elephants lived, & when present animals lived — we know the great time necessary to form channel (& Basses St.) yet no change in English species — time no element in *making* change, only in *fixing* it: only circumstances a contingency of time. |

- 140 When we multiply the effects of earthquakes¹, elevating forces in raising continents, & forming mountain-chains, when we estimate the matter removed by the waves of the sea, on beaches, we really measure the rapidity of change of forms, & instincts in the animal kingdom. — It is the unit of our calendar — epochs & creations reduce themselves to the revolutions of one system in the Heavens. —

Is not *puma* same colour as *lion* because inhabitant of *plain* & Jaguar of woods &c like ground birds. |

141-152 excised.

- 153 If an animal breeds young her growth is immediately checked — the *vis formativa* goes entirely to the offspring — This is clearly the converse of animal being rendered inessential, the hardness of life in female moth &c.

- Mr Y.² says that Macleay considers the house bug, as a female which has larvae which have bred before the *vis formativa* had completed them — (but the argument is *very weak* without knowing whether if kept they would have wings. —). — Says p. 84. Hens like Cocks from effect of heredity in & in. — Mr Yarrell does not know
154 of any case of old male becoming like female, though many | of old female becoming like cocks. — It is very singular so many Gallinaceous birds have cock & hen plumage so different, yet the Cassowary & Guinea fowl cannot be distinguished. —

A capon will sit upon eggs as well as & often better than a female. — this is full of interest, for it shows latent *instincts* even in brain of male. — Every animal surely is hermaphrodite — (as is seen in plumage of hybrid birds) |

- 155 After animal has copulated, though no offspring, milk sometimes comes in mammae, & even when bitch is in heat. —

Yarrell believes gestation is always some multiple of seven — if woman does not menstruate in the month, she will in 5 weeks. —

A Bull is never taken from his own field to bull a cow. — A dog if led in string will not. — Some of the tigers — cat, though caterwhalling & put into female when muzzled, he is disabled. — so elephant in confinement, & so *imagination* in man, has strange effect. — |

- 156 *Directly* a capon is cut, it increases in size *prodigiously* —

Animal Oeconomy by Hunter (edited by Owen) p. 34, — Owen³ classifies Hermaphrodites Cryptandrous (only female organs visible) Oyster, Cystic Entozoa, Echinoderms, Acalephes, Polyyps, Sponges.

Heautandrous, male organs formed to fecundate females (as in plants) Cirrhipeds, rotifers, trematode and cestoid Entozoa.

¹ This word crossed out in MS.

² William Yarrell. Personal communication.

³ Richard Owen, in John Hunter. *Observations on certain parts of the Animal Oeconomy with Notes by Richard Owen*, London 1837, footnote on p. 35 (not p. 34).

Allotriandrous Mollusca, with [*recte* without] pectinibranchiate order — the Annelida, all other¹ are Dioecious as Cephalopods, pectinibranchiate molluscs, insects, spiders crabs — (all these however do not require coition every generation) Epizoa, the nematoid Entozoa —

157 Therefore highness in scale has no constant relation to separation of sexes, as may be | seen in Monoecious & Dioecious plants. —NB. in Heautandrous animals is there gradation of structure leading to supposition, that the Cryptandrous are really Heautandrous. — How is fecundation effected in latter ; are organs open to water ? Would not ferns according to this doctrine be considered as really cryptandrous, & they have hybrids — This is most important support to my views — Seeing sexes separate in some of the lowest tribes, leads one to suppose still more that they must in effect be so in all. — 2 NB. In Pectinibranch mollusca or Cephalopoda are there abortive traces of other sexual organs ; for if so, separation of sexes very simple — as in plants. Even in same genus some dioecious & some monoecious — (& cultivation might make one set of organs barren in one plant & not in other). Hunter p. 36 is thought by Owen² to ask whether a Heautandrous animal is actually split in two — keeping sexes separate. Owen says such view worthy of a Lamarckian. — Mine is much simpler. — |

158 Hunter³ shows almost all animals subject to Hermaphroditism, — those organs which perform nearly same function in both sexes, are never double, only modified, those which perform very different, are both present in every shade of perfection. — How comes it nipples though abortive, are so plain in man, yet no trace of abortive womb, or ovarium, — or testicles in female. — the presence of both testes & ovaries in Hermaphrodite — but not of penis & clitoris, shows to my mind, that both are present in every animal, but unequally developed. — surely analogy of Molluscs & neuter bee would shew this. (Do any male animals give milk) — But this not distinctly stated by Hunter,⁴ — Do testes, & ovaria when |

159-160 excised.

161 Hunters Animal Oeconomy (by Owen)⁵ p. 44 Classification of Monsters (1) from præternatural situation of parts, (2) addition of parts, (3) deficiency of parts, (4) combined addition and deficiency of parts, as in Hermaphrodites. (shows my doctrine of Hermaphrodite differs from Hunter) — Hunter⁶ (p. 45) observes “ every species has a disposition to deviate from Nature in a manner peculiar to itself ”. Each part of each species not similarly subject. —

Divides sexual marks into primary & secondary, the latter only being developed when the first become of use. Great characteristic of male greater strength — (p. 45) and that strength⁷

In speaking of generation always put female first.

Will not even a fruit tree or rose degenerate during its life so that successive buds

¹ The word “animals” here crossed out in MS.

² Richard Owen, in John Hunter. *Ibid.*, p. 36 footnote c.

³ John Hunter. *Ibid.*, “An account of the Free-Martin”, p. 36.

⁴ John Hunter. *Ibid.*

⁵ Richard Owen in John Hunter. *Ibid.*, p. 44 footnote.

⁶ John Hunter. *Ibid.*, p. 45 “An account of an extraordinary pheasant”.

⁷ This sentence was crossed out by Darwin.

do differ — any variety is not handed down but is handed down for some generations. |

- 162 Theory of sexes (woman makes bud, man puts primordial vivifying principle) one individual secretes two substances, although organs for the double purpose are not distinguished, (yet may be presumed from hybridity of ferns) afterwards they can be seen distinct (in dioecious plants in their abortive sexual organs?): they then become so relates to each other as never to be able to impregnate themselves (this never happens in plants, only in subordinate manner in the plants which have male & female flowers on same stem. —) so that Molluscous hermaphroditism takes place. — thus one organ in each becomes obliterated, & sexes as in Vertebrates take place. — ∴ every man & woman is hermaphrodite : — ∴ developed instincts of capon & power of assuming male plumage in females, & female plumage in castrated male. — Men giving milk — |

- 163 Sept. 25th Young man at Willis¹ Gt Marlborough St Hair dresser assures me he has known many cases of bitch going to mongrel, & all subsequent litters having a throw of this mongrel. — I did not ask the question. — His bitch will not take, & if she did take, probably would not be fertile, without she knows & *likes him* & then is actually obliged to be held, — like she wolf of Hunter² — there is great difference between hybrids & inter se offspring in latter being unhealthy. — young take dis-temper very readily & are subject to fits. — *Males bred in & in never lose passion.* (mem. so it was said little cock yet very bad losing virile powers in Zoolog Gardens & Kings at Otaheite) Last litters are considered the most valuable because smallest sized dogs, — one litter big & then second small & so [on]. — Says there is breed of
164 Fowls called everlasting layers — or Polish breed (He thinks | half pheasant, half fowls) — eggs fertile but parent bird will never sit on them. —

May be just worth remembering that ovarium of women (Paper in Vol. I of Irish Royal Academy)³ have contained perfect *teeth* & hair, showing foetus has *gone on growing*, I believe same has happened in boys bodies.

- Lavaters Essays on Phy[siognomy]⁴ transl by Holcroft vol. I, p. 195 says children resemble parents in their bodies " It is a fact equally well known, that we observe in the temper, *especially of the youngest children*, a striking similarity to
165 the temper of the | father, or of the mother, or sometimes of both ". If L. can be trusted this is Lord Moretons⁵ law. — " How often do we find in the sons the *character*,

¹ Mr. Willis. Hairdresser cf. above MS. p. 24.

² John Hunter. *Ibid*, " Observations tending to show that the wolf, jackal, and dog, are all of the same species ", p. 319. On p. 324 :—" I communicated to Mr. Symmons my wish that we should endeavour to prove the fact of the wolf and dog being of the same species, by having either his female or mine lined by a dog."

³ James Cleghorn. " The History of an Ovarium, wherein were found Teeth, Hair and Bones," *Trans. Irish Royal Acad.*, 1787, vol. 1, p. 73.

⁴ John Caspar Lavater. *The Catalogue of the Library of Charles Darwin*, Cambridge 1908, lists this book as the French edition Paris 1820. In the translation by Holcroft (London 1840) on p. 369 the following words appear :—" . . . From all observations, on the resemblance between parents and children, which I have been able to make, it appears to me evident that neither the theory of Bonnet nor Buffon give any systematic explanation of the phenomena, the existence of which cannot be denied . . . sometimes, [they] resemble the mother, sometimes the father, often both, and often neither . . . " The edition which Darwin used has not been traced.

⁵ Lord Morton. " A Communication of a singular fact in Natural History ", (read November 1820), *Phil. Trans. Roy. Soc.*, 1821, vol. cxi, p. 20.

constitution, & most of the moral qualities of the father !! In how many daughters does the character of the mother revive! Or the character of the mother in the son, & of the father in the daughters ! ” This last remark good because showing probably not education. —

Cannot I find some animal with definite *life* & split it, & see whether it retains same length of life — like Golden Pippin trees? How is this with buds of plants, does *annual* give buds. — Life may be thus prolonged, bud being formed & one part dying for great length of time. — |

166 There is probably law of nature that any organ which is not used is absorbed. — this law acting against hereditary tendency causes abortive organs. — The origin of this law is part of the reproductive system, — of that knowledge of the part of what is good for the whole — if cut off nerves in snail¹ (*Encyclop of Anat & Phys*) can make a head: the other parts may surely absorb a useless member, — in fact they do it in disease & injury. —

167 The *sympathy* of parts is possibly part of same general law, which makes two animals out of one | & heals piece of skin, — if the tail knows how to make a head, & Head a tail, & the half both head & tail — no wonder there should be *sympathy* in human frame.

One of the final causes of sexes to obliterate differences, final cause of this because the great changes of nature are slow. if animals became adapted to every minute change, they would not be fitted to the slow great changes really in progress. —

Annals of Natural History, 1838, p. 123. Ehrenberg² makes gemmation in animals very different from that of plants (though latter does sometimes occur in animals). latter the division taking place from outside inwards & in animals from inside to the outside. is this not owing simply to more importance of internal regions in animals. One invisible animalcule in four days could form 2 cubic stone, like that of Billin [Bilin] |

168 It³ is very singular the same difference from parental stock having been repeated several times, that it becomes fixed in blood. — Looking at ovum of mother & ovum in offspring, as similar to the several ova in mother (with only difference of time) is the above law anyways connected with the case of successive copulation impresses offspring more & more with the added difference, like Lord Moretons⁴ case & Dr Andrew Smith,⁵ If A.B.C.D.E. be animals: if (X) male impresses ovum in A with

¹ T. Rymer Jones, “Gastropoda”, *Encycl. Anat. & Phys.*, London 1839, vol. 2, p. 396. Regeneration of the tentacles in snails was first demonstrated by Spallanzani and published in 1768. His results were confirmed by Voltaire in the same year. (Sir Gavin de Beer. *Science and the Humanities*, London, 1956).

² Christian Gottfried Ehrenberg. “Communication respecting Fossil and Recent Infusoria made to the British Association at Newcastle”, *Ann. Hist. Nat.*, 1838 (1839), vol. 2, p. 121. On p. 123:—“... or as many individual animalcules as contained in 2 cubic feet of the stone from the polishing slate of Bilin. This increase takes place by voluntary division; and this is the character which separates animals from plants. It is true that the gemmation in plants, especially in very simple cells, is at times very similar to the division in animals, but this relates to the form not to the formation. A vegetable cell apparently capable of self division always becomes one, or contemporaneously many exterior warts (gems) without any change in its interior. An animal which is capable of division first doubles the inner organs, and subsequently decreases exteriorly in size. Self division proceeds from the interior towards the exterior, from the centre to the periphery; gemmation, which also occurs in animals, proceeds from the exterior towards the interior, . . . ”

³ At the top of the page are the words “Generation [crossed out] v, p. 152.”

⁴ Lord Morton’ op. cit., p. 20.

⁵ Dr. Andrew Smith. Reference untraced.

some peculiarity that is (B) to some degree, & likewise ovum in (B) that in (C) in lesser degree — Then when (C) unites with male (X)¹ assume that every peculiarity
 169 has a tendency to descend to several generations | If A & B be two animals which have some peculiarity for first time, & if their all their offspring inherit the same peculiarity in lesser degree & theirs again in lesser degree — now if the second race both have this peculiarity strongly; they transmit with same force as first pair, but to this tendency is added the 3rd tendency from first pair. — Now if two of third pair of same peculiarity breed they will have the same influence as first pair + tendency they inherited from second pair, + the influence they themselves *inherit*.

Annals of Natural History² p. 96, vol. I. [*recte* II] Notice the Syngnathus or Pipe fish the male of which receives eggs in belly. — Analogous to men having mammae. — |

170 There is an analogy between caterpillars with respect to moths, & monkeys & men, — each man passes through its caterpillar state. The monkey represents this state. —

When it is said, that difference between bud & seed, that latter carries with [it] stock of food, — the generalization begins low — it goes through transformation nearly independently of its parent therefore wants independent supply of food, — is real difference — but this does not apply to potato. |

171 With respect to offspring being determined by impregnation of mother — we see in a litter every possible variation from being very near mother, & some very near father. — Now if one of these staid in the womb, when it came out, it might partake of shade of fathers character. — according to this view more semen to one child, more like father. — Stuff! — |

172 How much opposed the Quagga case appears to that of 2 dog[s] begetting different puppies out of same mother. —

The following views show the transmission of mutilation impossible it should be observed that transmission bears no relation to *utility* of change. hence *hare-lips* hereditary, *disease*, extinction.

The view that man or cock pheasant &c is abortive hermaphrodite is supported by change which takes place in old age of female assuming plumage of cock, & beards growing in old women — Stags horns & testes curious instance of corelation in structure — Neuter bee having both sexes abortive fact of same tendency. — Mammae in men having given milk, testes & ovaria. —

Animals in domestication (mem. elephant) not breeding — remarkable. Athenaeum 1838, p. 653. Ehrenberg³ thinks multiplication by division in development of gemma |

173-174 *excised*.

175 Why are twin[s] in man more like each other, than twins or triplets &c or in litter. Why is there some law about sexes of twins in former case. — (many monsters are really twins.) —

It is absolutely necessary that some but not great difference (for every brother & sister are somewhat different) should be added to each individual before he can procreate. then change may be effect of differences of parents, or external circumstances during life. — if the circumstances which must be external which induce

¹ From the words "If A.B.C.D.E" to here crossed out in MS.

² B. F. Fries. "On the genus Syngnathus", *Ann. Nat. Hist.*, 1838 (1839), vol. 2, p. 96.

³ Christian Gottfried Ehrenberg. *Athenaeum*, 1838, 8th Sept., p. 653.

change are always of one nature species is formed, if not — the changes oscillate backwards & forwards & are individual differences. (hence every individual is different). (All this agrees well with my view of those forms slightly favoured getting the upper hand & forming species.) — (Aphides having *fertile* offspring without coition or addition of differences, shows that difference need not be added *each time*, but after some time.)

What kinds of plants are monoecious or dioecious. Very curious how this was super-induced? (Surely all are really *dioecious*) only simple forms of life are monoecious. |

176 Proved facts relating to Generation.

One copulation may impregnate one or many offspring, it affects the subsequent offspring, though other male may have copulated. — two animals may unite & each have offspring by same mother. — one animal will fecundate female for several births, & even produce fertile offspring. — *Desire lost* when male & female too closely related: this most important with regard to theory, showing generation connected with whole system, as if there was a superabundance of life like tendency to budding, which wishes to throw itself off, — as may be inferred from annual plant being prolonged till it has bred. — Offspring like both father & mother, or very close to either. — Male & female as foetus one sex; & therefore both capable of
177 propagating, but one is rendered abortive | as far as parturition is concerned. — Generation being means to propagate & perpetuate differences, (of body, mind & constitution) in the end frustrated, when near relations & therefore those very close are bred into each other. — this is somehow connected. (This seems case, for by careful observing cattle can be bred in & in.) — The life of *passion* in hybrids perhaps connected with this same case (& not merely as I have stated it) it is certainly very remarkable that too much difference should produce same effect as too little, — in (latter case female often takes males but does not produce) tendency to deformity this does not happen with hybrids? Plants must stand much breeding in & in (those which have solitary flowers) exotics brought from foreign country & so must those forms which are produced by budding only as cryptogams & hydras — (this repugnance to breeding in & in seems connected with more developed forms). Study buds — gemmae & monocotyledonous, do those which are monocotyledons have many flowers in same spath, as they have only one *bud*. — |

178 Every individual foetus would reproduce its kind was it not for the necessity of some change. Without some small change in form, ideosyncrasy or disposition were added or subtracted at each or in *several* generations, the process would be similar. to *budding* which is not object of generation. — therefore passions fail. — In fruit trees no doubt there is tendency to propagate the whole difference of parent tree, but it fails. Therefore crab seedlings of one apple ought to differ from those of other. — The upshot of all this is that effect of male is to impress some difference to make the *bud* of the woman not a bud in every respect. — Is this connected with the physical differences in almost all male animals? If the male in the case of some generations has gained some difference from what it received (for it is probable that breeding more in would not be deleterious if the relation had come from different quarters) then it causes a secretion of something someways different from himself, for it
179 should be observed that from | the effects of breeding in, it is not merely the too

close animals which will not breed, but the female at least (?male?) loses all appetite. — It is the comparison of each animal with its ancestors, and not its comparison of difference with other sex.

The highest bred Blood hound would be infertile with highest bred of other ? breed. Therefore it is not really breeding in & in but breeding animals that have neither varied from their stock, for to breed (as Sir J. Sebright¹ urges?) one with opposed characters is by impliance to breed two which have each varied from parent stock. — The very theory of generation being the passing through whole series of forms to acquire differences, if none are added, object failed, & then by that corelation of structure, desire fails. Every individual except by incestuous marriage has acquired from father some differences v. Sykes.²

Books to read Buffon Suites³ &c. — Horse & cattle Library of useful Knowledge.⁴ Bell's Quadrupeds.⁵ |

180 Will ova of fishes & Mollusca & Frogs pass through birds stomachs & live ?

In Muscovy ducks do young take most after father or mother, according as they are crossed ? & how is it with China & Common geese. How are their instincts ? Chinensis & Common pigs. —

Experimentize on crossing of the several species of wild fowl of India, with our common ones in Zoolog. Gardens⁶ :

Buffalo, common cattle, Esquimaux (& Australian) dogs with common dogs⁶ —

Ask my father to look out for instances of avitism.

Examine English breeds in hot houses, will they flower.

Make Hybrids with moths, where fecundation can be made artificially. — |

Inside back cover :

Are hybrids pintail & common duck similar inter se ? Zoolog. Gardens.⁶

Are the hybrids of those species which cross & are fertile heterogenous ?

When bird fanciers say the throw of two varieties is uncertain do they mean they cannot tell first result, or that hybrid breed is uncertain.⁶

Is there any peculiarity or variation common to any zoophyte both in succession which is not transmitted by generation ??

Is it chiefly in high bred dogs i.e. (bred in & in) that one copulation with other dogs renders subsequent progeny faulty. Does male fail in passion. —

Disposition of half bred cattle at Combermere ? How is jackall & dog of Z. Gardens.

¹ Sir John Sebright. Reference untraced.

² Col. William Henry Sykes. Reference untraced.

³ *Collection des Suites à Buffon, formant avec les oeuvres de cet auteur un cours complet d'Histoire Naturelle*, Paris 1834 (or other edition).

⁴ William Youatt. "The Horse, with Treatise on Draught", *Library of Useful Knowledge*, Farm Series, 53, 1831; "Treatise on British Cattle, their Breeding, Management and Diseases", *Library of Useful Knowledge*, Farm Series, 51, 1834.

⁵ Thomas Bell. *A history of British quadrupeds, including the Cetacea*, London 1837. This list of books is at the top of the page and crossed out in MS.

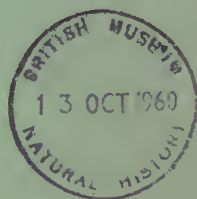
⁶ This sentence is crossed out in MS.



PRINTED IN GREAT BRITAIN BY
ADLARD AND SON, LIMITED
BARTHOLOMEW PRESS, DORKING

DARWIN'S NOTEBOOKS
ON TRANSMUTATION OF
SPECIES
PART IV

Edited with an Introduction and Notes by
SIR GAVIN DE BEER



BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
HISTORICAL SERIES
LONDON: 1960

Vol. 2 No. 5

DARWIN'S NOTEBOOKS ON
TRANSMUTATION OF SPECIES
PART IV. FOURTH NOTEBOOK
(OCTOBER 1838—10 JULY 1839)

Edited with an Introduction and Notes

BY

SIR GAVIN DE BEER



Pp. 151-183

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
HISTORICAL SERIES
LONDON: 1960

Vol. 2 No. 5

THE BULLETIN OF THE BRITISH MUSEUM
(NATURAL HISTORY), *instituted in 1949, is
issued in five series, corresponding to the Departments
of the Museum, and an Historical series.*

*Parts appear at irregular intervals as they become
ready. Volumes will contain about three or four
hundred pages, and will not necessarily be completed
within one calendar year.*

This paper is Vol. 2, No. 5 of the Historical series.

© Trustees of the British Museum, 1960

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued September, 1960

Price Fifteen Shillings

DARWIN'S NOTEBOOKS ON TRANSMUTATION OF SPECIES

Edited with an Introduction and Notes by

SIR GAVIN DE BEER

PART IV. FOURTH NOTEBOOK. (OCTOBER 1838 TO 10TH JULY 1839)

INTRODUCTION

DARWIN'S Fourth Notebook on Transmutation of Species was written after he had read Malthus's¹ *Essay on the principle of population* on 3rd October, 1838. The first two pages subsequently cut out by him and now lost, were doubtless devoted to Malthus's work, as is the third page. Considering the importance of the influence which Malthus's book was thought (even by Darwin himself in later life) to have exerted on Darwin's work and ideas, it is significant that he devoted so little space to Malthus in the Notebook which he wrote immediately after reading his book. The reason, as explained in the Introduction to Darwin's Third Notebook on Transmutation of Species,² is that Darwin had already and independently thought out the principle of selection of favourable variations and seen the possibility that the transmutation of species might be explained by its means. What Malthus gave Darwin was evidence of the rigorousness of selection and of the inevitability of widespread mortality.

To this concept, Darwin introduced the notion of extinction as the extreme case of depopulation (IV 3), and the notion of variation; and he showed that he was well aware that this would lead to results very different from those which Malthus thought that he had achieved. This fact emerges clearly from the only other passage in the Fourth Notebook where Darwin refers to Malthus and is concerned to show that he does not subscribe to Malthus's assumption that the variation possible in cultivated plants and domestic animals is strictly limited. "It may be said that wild animals will vary according to my Malthusian views, within certain limits, but beyond them not, — argue against this" (IV 136). The term "Malthusian views" does not mean acceptance of Malthus's economic and political system, but solely adherence to the view that mortality ensues from reproduction outstripping food-supply. The parallel between the effects of artificial selection in producing new breeds of cultivated plants and domesticated animals, and of natural selection in producing new species is clearly formulated: "It is a beautiful part of my theory,

¹ Darwin used the 6th edition, London 1826.

² *Bull. Brit. Mus. (Nat. Hist.)* Historical Series, vol. 2, part 4, 1960.

that domesticated races of organics are made by precisely same means as species — but latter far more perfectly and infinitely slower" (IV 71).

A soliloquy on the mechanism of natural selection takes the following form: "it is difficult to believe in the dreadful but quiet war of organic beings going on in the peaceful woods and smiling fields" (IV 114). The fact that natural selection applies to man is adduced as additional evidence that man is of similar nature to animals. "When two races of men meet, they act precisely like two species of animals, — they fight, eat each other, bring diseases to each other &c., but then comes the most deadly struggle, namely which have the best fitted organization, or instincts (i.e. intellect in man) to gain the day" (IV 63). It is not difficult in this passage to recognize experiences which Darwin underwent during the voyage of the *Beagle*.

With regard to the evolution of man and the question whether his ancestors were bimanous or quadruped, Darwin had already seen the importance of embryonic development and vestigial organs in determining affinity and therefore descent. "There being no fossils, the only way, that I can see to discover whether the parent of man was quadruped or bimanous, is to see, what parts of structure abortive." (IV 66). That was written during the first half of December 1838, and on 6th January, 1839 comes the solution: "The rudiment of a *tail* shows man was originally *quadruped*" (IV 89).

Morals are the result of evolution from "social instincts, which as I hope to show is probably the foundation of all that is most beautiful in the moral sentiments of the animated beings" (IV 49).

The notion of fortuitous as distinct from designed variation is clearly expressed: "my principle being the destruction of all the less hardy ones & the preservation of *accidental* hardy seedlings" (IV 111). That survival is not fortuitous but is undesignated emerges from the following passage: "seeing the beautiful seed of a Bull Rush I thought, surely no 'fortuitous' growth could have produced these innumerable seeds, yet if a seed were produced with infinitesimal advantage it would have better chance of being propagated" (IV 137).

The "tendency to progression" postulated by Lamarck as an inherent quality of living organisms which would make natural selection unnecessary in those cases where it has resulted in improvement, quickly attracted Darwin's attention as a principle to be tested. "See if any law can be made out, that varieties are generally additions, & not abortive: with reference to the non-necessity of the so-called progressive tendency law" (IV 70). Soon comes the answer, and it opens up the whole science of ecology: "The enormous *number* of animals in the world depends of their varied structure and complexity. — hence as the forms became complicated, they opened *fresh* means of adding to their complexity" (IV 95). Here Darwin shows that he has realized the part which organisms themselves play in the complex of factors which make up the environment of other organisms. He continues: "but yet there is no *necessary* tendency in the simple animals to become complicated although all perhaps will have done so from the new relations caused by the advancing complexity of others. — It may be said, why should there not be at any time as many species tending to dis-development, . . . my answer is because, if we begin

with the simplest forms & suppose them to have changed, their very changes tend to give rise to others" (IV 95). Darwin concludes: "I doubt not if the simplest animals could be destroyed, the more highly organized would soon be disorganized to fill their places" (IV 96). Improvement, where it takes place, is not the result of any innate tendency to progression, but to competition and adaptation. "Considering the Kingdom of nature as it now is, it would not be possible to simplify the organization of the different beings, . . . without reducing the number of living beings — but there is the strongest possible [tendency] to increase them, hence the degree of developement is either stationary or more probably increases" (IV 97).

The ecological web of life is so closely netted that when transmutation of species results in the origin of a new one, a new problem is created. "When a species becomes rarer, as it progresses towards extermination, some of the species must increase in number where then is the gap for the new one to enter?" (IV 43). The solution to this problem is closely connected with the principle of divergence¹ which Darwin did not solve until 1852.

Darwin was alive to the problems of what are now known as ring-species. "Lyell tells me . . . that Hooded crow and Carrion crow have in Europe different ranges latter not going north of the Elbe, yet they meet in one wood in Anhalt & there every year produce hybrids" (IV 101, 102).

It is curious to find Darwin speaking of final causes regarding the existence of separate sexes, but the analysis developed in this and the following two pages of the consequences of their existence, and of what the result would be if there were only unisexual generation, is remarkably acute, particularly the realization of the advantages accruing from slow change in adaptation to the general conditions of the habitat instead of rapid changes in adaptation to local conditions (IV 48, 49, 50). Variation would be entirely unconnected in any groups of individuals and change would be unarchic. Furthermore, physical factors would act on individuals without restraint. The value of sexual reproduction is therefore that it canalizes variation into a small number of channels by making physical factors act not on single individuals but on interbreeding populations, and it slows down change with the result that changes can "bear relation to the whole changes of country, & not to the local changes" (IV 50).

Researches into the progress of ideas in the minds of those who solved the problem of evolution and natural selection are by no means complete, but it is already possible to see two curious patterns in the history of thought. The first relates to the manner in which arguments have simply been turned upside down as a result of progress of knowledge. The foremost example of this reversal of direction is the fate of Paley's arguments aimed at proving that the adaptations of plants and animals to their environment show evidence of purposive design.² First of all it must be remembered that Paley selected his evidence. There are not wanting cases of mal-adaptation. Every case of a parasite killing its host is a blunder of nature, reflecting no credit on

¹ In a letter which Darwin wrote to George Bentham on 19th June, 1863, *Life and Letters*, vol. 3, p. 26, he said: "I believe that it was fifteen years after I began before I saw the meaning and course of the divergence of the descendants of any one pair." If 1837 was the date when he began, this works out at 1852.

² William Paley: *Natural Theology*, London 1836.

any designer, and the same is true of many structures and functions, such as the prostate and the proneness of man to hernia as a result of his upright carriage. However, as a result of Darwin's work, the same facts as were adduced by Paley as proof of beneficent design are now recognized as evidence of what natural selection can achieve without any design at all. Indeed, if there were a designer, he would have to be singularly malevolent to produce all the failures and suffering caused.

Another case of inversion is provided by Lyell's attempt to use the principle of uniformitarianism to show that evolution could not have occurred, because catastrophism involved progressionism and catastrophism must be rejected.¹ Again as a result of Darwin's work, it is now clear that application of the principle of uniformitarianism shows that evolution must have occurred, because organic progressionism is the only correct interpretation of the facts in spite of catastrophism being erroneous.

Thirdly, both Lyell and Blyth² used the principle of natural selection, implicit in the penalization of variants from the specific type, to prove that species remain constant; whereas Darwin and Wallace showed that this argument must be turned on its head to show that natural selection can make varieties depart indefinitely from the specific type. This last case is particularly instructive, because natural selection can in some cases bring about change and in other cases preserve stability, and T. H. Huxley³ showed that natural selection was the only agency that could account for this facultative alternative. The reason for this is known, because Mendelian heredity is a mechanism which can according to circumstances produce diversity or stability. The former capacity is based on the power of mutation, crossing-over, segregation, and recombination of genes; the latter on the particulate nature of the non-contaminating genes and on chromosome linkage.

Finally, the most remarkable case of all of reversal concerns the conclusion which Malthus drew from his argument based on the check which limitation of food-supply was supposed to impose on human fecundity and population increase. Since Malthus did not consider the possibility of variation in the population, he concluded that the results of checks to increase resulted merely in keeping numbers down, the quality of the population remaining the same as before. And since he believed that the practice of cultivation of plants and breeding of domestic animals showed that they were limited and not indefinitely perfectible, he concluded that the struggle for existence was an obstacle to the improvement of man just because it kept numbers down. In other words, Malthus's principle of population meant quantitative natural elimination without selection. As Conway Zirkle⁴ has pointed out, Malthus was prevented from anticipating Darwin by his opposition to the ideal of human perfectibility embodied in the works of Condorcet⁵ and Godwin.⁶ Darwin and Wallace, independently, introduced into the argument the variability of plants and animals of which

¹ Charles Lyell: *Principles of Geology*, vol. 2, London 1832, See Introduction to *Darwin's First Notebook on Transmutation of Species* (Bull. Brit. Mus. (Nat. Hist.), Historical Series, vol. 2, 1960, p. 33.)

² Edward Blyth. See Introduction, *ibid.*, p. 36.

³ T. H. Huxley: "Evolution in Biology", *Encyclopaedia Britannica*, 9th Edition, vol. 8, p. 751.

⁴ C. Zirkle: "Natural Selection before the Origin of Species", *Proc. Amer. Phil. Soc.*, vol. 84, 1941, p. 101.

⁵ Antoine-Nicolas de Condorcet: *Sketch for a Historical Picture of the Progress of the Human mind*, London 1795.

⁶ William Godwin: *Enquiry concerning political justice and its influence on virtue and happiness*, London 1796.

they were aware both in artificial conditions and in nature. Familiar with the results of artificial selection, Darwin had already seen that selection in nature would cause species to vary from the original type ; and both he and Wallace, independently, saw that Malthus's principle of quantitative limitation working on natural populations must inevitably result in natural selection of the better adapted variants through a qualitative elimination, and they used the struggle for existence to explain the possibility of departure of varieties from the original type until they became new species ; which was exactly the opposite of Malthus's conclusion.

The second pattern in the history of thought is the realization that knowledge at a given time may already be sufficient to suggest the correct solution of a problem, if only the scientist knows where to look. The best example of this phenomenon, that science is sometimes richer than is imagined, is provided by Darwin himself. None of the ingredients which he required, both to establish the fact of evolution and to show that natural selection provided the explanation of how species become modified, was unknown to Lyell who missed the great chance, partly by failing to test the imaginary link between catastrophism and progressionism, and partly because his mind was orientated away from transmutation of species for reasons of theological orthodoxy. How close Lyell came to the facts without recognizing them may be seen in the second volume of his *Principles of Geology* published in 1832. There, in Chapter XI he actually speculated on the extinction of old species and the appearance of new species and asks (p. 179) " is it possible that new species can be called into being from time to time, and yet that so astonishing a phenomenon can escape the observation of naturalists ? " This problem was referred to in a remarkable letter dated 20 February 1836 from Sir John Herschel to Lyell, to which Darwin himself alluded in his Fourth Notebook (MS. page 59, below). The reference,¹ which I owe to Dr. Sydney Smith, is as follows : " Of course I allude to that mystery of mysteries, the replacement of extinct species by others. Many will doubtless think your speculations too bold, but it is as well to face the difficulty at once. For my own part, I cannot but think it an inadequate conception of the Creator, to assume it as granted that his combinations are exhausted upon any one of the theatres of their former exercise, though in all this, as in all his other works, we are led, by all analogy, to suppose that he operates through a series of intermediate causes, and that in consequence the origination of fresh species, could it ever come under our cognizance, would be found to be a natural in contradistinction to a miraculous process, although we perceive no indications of any process actually in progress which is likely to issue in such a result."

Another example is that of Sir Ronald Fisher's² demonstration that, far from being antagonistic and mutually exclusive, Darwinian selection and Mendelian genetics are complementary and indispensable to each other. Here, it was William Bateson who missed his great chance of effecting the synthesis by failing to recognize the fact that mutations may have infinitesimal and cumulative effects, and the possibility that selection might have played a part in controlling the effects of mutations. Al-

¹ Charles Babbage. *The IXth Bridgewater Treatise*. London 1837, p. 203. Darwin used the 2nd edition of this work which has not been consulted.

² R. A. Fisher : *The Genetical Theory of Natural Selection*, Oxford 1930.

though he had available to him all the basic ingredients out of which Fisher constructed his synthesis, Bateson was blinded by the clean-cut results of such Mendelian crosses as were known to him, appearing to have arisen ready-made without selection, and this prejudiced him against Darwinian selection. He was eventually driven to the untenable view that evolution had been stopped down at the start, and had occurred through the successive removal of inhibitory factors.¹

The lesson to be derived from this is that even today there may be great syntheses waiting to be assembled from materials that are already to hand.

Darwin's Fourth Notebook on Transmutation of Species, also known as Notebook "E", is Darwin MS. 124 in the Cambridge University Library, to the authorities of which acknowledgement is warmly made for their unfailing assistance and courtesy.

As in the other Notebooks, a number of pages were cut out by Darwin in 1856, and seventy eight pages have thus been lost. Since the texts of Darwin's Notebooks on Transmutation of Species were sent to the press, some of the excised pages have been found in the British Museum (Natural History) and in the Cambridge University Library. These will be transcribed and published in a subsequent number of the Bulletin, together with Corrigenda and an Index of the names of persons referred to by Darwin.

Editorial Note

The general policy of this edition has been to present a text, which is already difficult enough in its contents, with the minimum of complication. It is not intended to be a facsimile edition.

The handwriting of the Notebooks is extremely difficult to decipher, because of letters indistinctly made, abbreviations and slurred endings to words, and ungrammatical construction of sentences. The use of capital and lower case letters is variable, as is the punctuation. The text is littered with dashes and with stops to which it would be misleading to attribute the value of periods in all cases. Many of them require the value of commas and are shown as such where the sense would otherwise be obscured. There are also several places where lines are drawn across the page, but no attempt has been made in this edition to reproduce them as rules. The use of different pens, inks, and of pencil here and there occurs frequently. In some cases the change appears to have no significance other than that he had temporarily run out of the instrument he had been using; in other cases it means that entries were made subsequently, often between the lines, and these are noted where they appear to be significant.

Where words that are essential for the sense of the text were inadvertently omitted by Darwin they have been added between square brackets. In some places Darwin inserted square brackets, apparently subsequently, to indicate special emphasis and perhaps to show passages which he wanted to copy out. They have been indicated where significant by footnotes, but square brackets are exclusively reserved for editorial intercalations by me.

Two kinds of erasure occur in the text. In the first, words were resolutely struck

¹ William Bateson: "Evolutionary Faith and modern doubts", *Science*, vol. 55, 20th January, 1922.

out by Darwin because they were wrong and not what he meant to write, or because he changed the construction of his sentence. Since such words seldom serve any purpose in elucidating the sense of the text but add to its existing complexity, Darwin's own verdict on them has been accepted and they have been omitted without indication, save in exceptional cases. In the second type of erasure sentences or whole pages have been lightly scored through, doubtless to indicate that they have been dealt with, and such erasures have been ignored.

I do not doubt that even allowing for the simple editorial style here adopted, many misreadings of the text have been made, to which corrections will be welcomed for the Corrigenda and Addenda which it is hoped to publish ; but if any reader requires more information than this edition gives, he must be referred to the manuscripts in the Cambridge University Library.

Acknowledgments

It is a pleasure to record my indebtedness to Sir Charles Darwin, K.C.B., F.R.S., in whom the copyright of the Darwin manuscripts is vested ; the Syndics of the Cambridge University Library and to Mr. H. R. Creswick, M.A. Librarian, in whose care the manuscripts are preserved ; to Lady Barlow for innumerable kindnesses and information of inestimable value for this work ; to Dr. Sydney Smith for his kind criticism and invaluable help ; to Professor S. L. Sobol of the Institute for the History of Natural Science and Technology of the U.S.S.R., Moscow, for the support of his agreement with my reading of the text of the First Notebook ; to Mr. P. J. Gautrey of the Cambridge University Library for his valuable help in searching for missing pages of the Notebook ; to Mr. A. C. Townsend, Librarian of the British Museum (Natural History) ; to Mr. M. J. Rowlands of the General Library, British Museum (Natural History), and to Miss Maria Skramovsky, my secretary, for their unremitting assistance in transcribing Darwin's handwriting and tracing references.

Gavin de Beer

DARWIN'S FOURTH NOTEBOOK ON TRANSMUTATION
OF SPECIES 1838-1839

Inside front cover.

Finished July 10th 1839. —
Selected Dec 15 1856 |

1-2 excised.

3 Epidemics¹ seem intimately related to famine, yet very inexplicable. —

ditto p. 529 "It accords with the most *liberal*! spirit of philosophy to believe that no stone can fall, or plant rise, without the immediate agency of the deity.² But we know from *experience*! that these operations of what we call nature, have been conducted *almost*! invariably according to fixed laws: and since the world began, the causes of population & depopulation have been probably as constant as any of the laws of nature with which we are acquainted". — This applies to one species — I would apply it not only to population & depopulation, but extermination & production of new forms. — this number & correlations |

4 Octob. 4th. [1838] It cannot be objected to my theory, that the amount of change within historical times has been small — because change in form is solely adaptation of whole of one race to some change of circumstances; now we know how slowly & insensibly such changes are in progress — we feel interest in discovering a change of level of a few feet during the last two thousand years in Italy,³ but what change would such a change produce in climate vegetation &c. — It is the circumstance of small physical changes & oscillations, not affecting organic forms, that the whole value of the geological chronology depends that most sublime discovery of the genius of man. |

5-14 excised.

15 sorts come up from it, lately saw a nonpareil sowed by Mr Tollet⁴ so produce. — thinks it probable that great part of those varieties may be due to impregnation from other apple trees. — now seeds of crab produce crab, so that some effect from apple trees is produced. — Thinks probably experiment was never tried of separating apple tree entirely from all others & so my experiment of strawberry⁵ not so absurd. —

16 Thinks that such variety as red cabbage | produced from passage from *many varieties*, & probably would take long before all the stain would be got out of it. — Now this is curiously different from primrose suddenly produce *cowslip*, one is tempted to think here some anomaly — I can fancy cowslip producing primrose return to old stock, but not primrose producing cowslip |

17 Uncle J.⁶ says common belief that female plant impresses main features on offspring & male the lesser peculiarities, — brilliancy of inflorescence

Gardeners by chance sometimes graft pears on apples they will live. but not flourish — a medlar may be grafted on pear. Mountain-ash & white Thorn !

¹ Thomas Robert Malthus. *An Essay on the Principle of Population*, 6th edition, London 1826, vol. 1, especially book I, chapter 6; and book II, chapter 13.

² Thomas Robert Malthus. *Ibid.* vol. 1, p. 529. Malthus wrote "divine power" instead of "the deity".

³ The reference is to the submergence and re-emergence of Roman buildings at Pozzuoli described by Charles Lyell: *Principles of Geology*, London, vol. 1, 1830, pp. 449, ff.

⁴ Mr. Tollet of Betley Hall, cattle breeder, cf. *Variation of Animals and Plants*, London 1868, vol. 2, p. 199.

⁵ The reference to Darwin's experiments with strawberries has not been traced.

⁶ John Hensleigh Allen of Cresselly.

Species not being observed to change is very great difficulty in thick strata, can only be explained by several strata being merely leaf.¹ if one river did form sediment in one spot, for many epochs such changes would be observed. — |

- 18 G. W. Earl's Eastern Seas, p. 206 — shot a monkey, ceased their cries, " many of them descending to examine their defunct companion ".² —

p. 229 Borneo — only animals he heard of pigs, small bears or badgers, deer, apes, baboons, monkey & an animal probably a tapir.³ —

p. 233. dogs in Borneo brought probably by Chinese⁴ " the breed⁵ of the latter being the same as the fox-like animals which are met with near Canton ".⁶ " Here as in all Malay countries, I noticed a peculiarity⁷ |

19-22 excised.

- 23 Macleay⁸ says it is nonsense to say take a tooth of any animal (as Toxodon) & say its relations, — if we know its congeners then we can. — Now on my theory this certainly can be accounted for, on any other it is the will of God. —

Octob. 16th. A very strong passage might be made — why seeing great variation in external form of varieties, do we suppose bones will not change in *number* (even *species* do not this), because it has been so pronounced ex cathedrâ. Let us look at facts. considering few domestic animals few that have not.⁹ cows hornless (horses not) |

- 24 If they give up infertility in largest sense as test of species, — they must deny species which is absurd. — Their only escape is that rule applies to *wild* animals only. from which plain inference might be drawn that whole infertility of hybrid receive no explanation was consequent on mind or instinct now this is directly incorrect.

The case of my mice¹⁰ is good, because it is an involuntary variation made by man. common to every individual & therefore effect of climate. — |

25-30 excised.

- 31 Did *man* spread over world as early as Elephants &c. — if in next 20 years none of his remains found in the Americas probably did not. —

Octob. 25th. I observed in Windsor Park — the Fallow Deer which were of a nearly

¹ Darwin's meaning is that many of the individual strata are as thin as a leaf of a book and contain no fossils. It is an adaptation of Lyell's analogy between Geological formations and a book with most of its leaves torn out and lost.

² George Windsor Earl. *The Eastern Seas or Voyages and Adventures in the Indian Archipelago in 1832-33-34*. London 1837, p. 206. The author uses the word "comrade" instead of "companion" as quoted by Darwin.

³ George Windsor Earl. *Ibid.* p. 229.

⁴ The words "brought probably by Chinese" were crossed out by Darwin in the MS.

⁵ In the MS. the word "being" is inserted here.

⁶ George Windsor Earl. *Ibid.* p. 233.

⁷ George Windsor Earl. *Ibid.* p. 233: "Here, as in all Malay countries I noticed a peculiarity in the cats, which I never heard satisfactorily accounted for. The joints near the tip of the tail are generally crooked, as if they had been broken".

⁸ William Sharp Macleay. Presumably personal communication. Darwin is contending that the relatives of a form can be identified by similarities in the structure of parts and that this can be accounted for on the theory of descent by modification from common ancestors.

⁹ The word "not" is repeated here in the MS. after the word "which" crossed out.

¹⁰ "My mice": cf. G. R. Waterhouse. "Species of the Genus *Mus*, forming part of the collection presented to this Society by Charles Darwin, Esq." *Proc. Zool. Soc. Lond.*, vol. 5, 1837, p. 15.

uniform blackish brown yet retained a trace of horizontal mark on flanks ; & tail & kind of semi-lunar mark¹ on each side darker, so that whole colour is changed, these best marked characters are partly retained, therefore colours vary in same manner as they would vary, if in wild state : thus mark on ear of cats be barred |

32 Ditto saw what was said to be hybrid between silver & gold fish.

Octob. 26th. If hereafter M[astodon] angustidens be found to be inhabitant of S. America & as it is embedded with almost recent shells. — shows that progression of change in Molluscs is somewhat similar in two hemispheres. — It might be worth investigating whether Megatherium & Mastodon are embedded in N. America. see my Journal² for references.

In such cases as at Galapagos where different islets have different forms it is either effects of having been long separated, or having never |

33-36 excised.

37 from its master. — dogs when strayed hang their tails. —

November 1st — Addenda to Journal.³ I show erratic blocks transported far S. in Northern Hemisphere — likewise far North in Southern. — Great animals of same two great orders destroyed about same time in North & South America. — Whole world formerly possessed a climate compared to S. America at present days, which S. America now does to North America & Europe. — S. America favourable
38 to Tropical productions. | The world formerly much more so, yet climate of same order as that of S. America. — (Explained by profound views of Lyell)⁴

Now Equatorial America from the low limits of blocks both North & South, has probably undergone a greater change, than any parts, (except Europe in which all Tropical forms have been obliterated) of the world. from the Equable kind of |
39 climate to the extreme. — Therefore species which were filled from such a preeminently equable climate might not have been able to have survived a change, (& become transmuted), although other parallel species in other continents might have survived this mundane change. — Therefore I argue from this that Africa & East Indian Archipelago formerly were not so very *equable*, or so *tropical*, & therefore present
40 state of world is not so different, with | regard to their productions. — Hence it is, from the ancient preeminently equable & temperate climate of America, that the Mammalia of S. America are as different from the existing orders, as the Eocene of Paris ! (Great Edentates at that period) Analyse this, — consider state of |

41-42 excised.

43 If species change, we see external conditions have great effect on them, & therefore extermination becomes part of same law. —

When we know what a great effect light has in colouring plants, — who can say what colours acting by a most delicate organ, on the whole system may produce ?

¹ A small sketch here in MS.

² Charles Darwin. *Journal of Researches into the Geology and Natural History of the Various Countries visited by H.M.S. Beagle*, London 1839, p. 152.

³ Charles Darwin. "Darwin's Journal", *Bull. Brit. Mus. (Nat. Hist.) Historical Series*, vol. 2, 1959 p. 8 ; against the date October 27, 1838 is the entry : "Preface and addenda on Theory of Erratic Blocks to Journal [of Researches]". cf. *Journal of Researches*, London 1839, p. 288.

⁴ Charles Lyell. *Principles of Geology*, 5th edition, London 1837, vol. 1, p. 138.

When a species becomes rarer, as it progresses towards extermination, some of the species must increase in number where then is the gap, for the new one to enter? — |
 44 The wonderful species of Galapagos must be owing to their islands having been purely results of *elevation*. — all modern & wholly volcanic — Azores might be prophesied to have this character. — Worth going there for. — Gales of wind would blend species.

Buckland¹ *Reliquiae Diluvianae* p. 222. Bones of Horse, Bear & Deer at 16000 feet
 45 with snow on Himmalaya — Humboldt bones | at 7800 in Andes² — parallel & curious facts. — The Himmalaya case bears on the vast changes even in that quarter of the world. — Mem. elevation & subsidence of East Indian Archipelago now rising.

On a particular part of coast of Somersetshire the Cockles are all apt to be diseased & some of them asymmetrically, — it is easy to get 50 of same kind of monstrosities G. B. Sowerby.³ — |

46 Looking over Lamarck⁴ surprised to see how many Tropical genera come from New Holland. ?Sydney?

The dog being so much more intellectual than fox, wolf &c &c — is precisely analogous case to man exceeding monkeys. — |

47 Having proved mens & brutes bodies on one type : almost superfluous to consider minds. — as difference between mind of a dog & a porpoise was not thought overwhelming — yet I will not shirk difficulty — I have felt some difficulty in conceiving how inhabitant of Tierra del Fuego is to be connected with civilized man. — ask the Missionaries about Australian yet slow progress has done so. — Show a savage dog, & ask him how wolf was so changed. |

48 When discussing extinction of animals in Europe ; the forms themselves have been basis of argument of change. — now take greater area of water & snow-line descent. I do not wish to say only cause, but one great final cause, nothing probably exists for one cause. My theory gives great final cause of sexes in separate animals : for otherwise there would be as many species, as individuals, & though we may not trace out all the ill effects, — we see it is not the order in this perfect world, either |
 49 at the present, or many anterior epochs. — but we can see if all species, there would not be social animals. hence not social instincts, which as I hope to show is probably the foundation of all that is most beautiful in the moral sentiments of the animated beings — &c. this⁵ is stated too strongly. for there would be innumerable species & hence few only social there could not be one body of animals. life with certainly another

Whether he was or not He is [at] present a social animal. If man is *one* great object

¹ William Buckland. *Reliquiae Diluvianae or Observations on the Organic Remains in Caves, Fissures, and Diluvial Gravel, and other Geological Phenomena attesting the action of an Universal Deluge*, London 1823, p. 222 : " But in Central Asia the bones of horses and deer have been found at an elevation of 16,000 feet above the sea, in the Hymalaya mountains . . . "

² William Buckland. *Ibid.* p. 222 : " we have in America the bones of the mastodon at an elevation of 7800 feet above the sea, in the Camp de Géants, near Santa Fe de Bagota ; and another species of the same genus in the Cordilleras, found by Humboldt, at the elevation of 7200 feet . . . "

³ George Brettingham Sowerby. Possibly personal communication.

⁴ Jean-Baptiste de Lamarck. *Genera of Shells*, translated by John George Children, n.p. 1823.

⁵ The words from here to the end of the paragraph are inserted between lines, and the last four words are uncertain. Perhaps " purpose " was intended at the end,

for which the world was brought into present state, — a fact few will dispute, (although, that it was the sole object, I will dispute, when I hear from the geologist the history, from the astronomer that the moon probably is uninhabited) & if my theory be true then the formation of sexes rigidly necessary. — |

- 50 Without sexual crossing, there would be endless changes, & hence no feature would be deeply impressed on it, & hence there could not be *improvement*, & hence not in higher animals — it was absolutely necessary that Physical changes should act not on individuals, but on masses of individuals. — so that the changes should
 51 be slow & bear relation to the whole changes of country, & not to the local | changes — this could only be effected by sexes. all the above should follow after discussion of crossing of individuals with respect to representative species, when going North & South.

Thinking of effects of my theory, laws probably will be discovered of corelation of parts,¹ from the laws of variation of one part affecting another. —

- (I from looking at all facts as inducing towards law of transmutation, cannot
 52 see the deductions which are possible.) — Ascertainment of | closest species (& naming them) with relation to habits, ranges & external conditions of country, most important & will be done to all countries, — but naming mere single specimens in skins worse than useless. — I may say all this, having myself aided in such sins. Yet there is no cure (do not add name without reference to description), except describers having some high theoretical interest, — “the great end must be the law & causes of change”. — A philosopher would as soon turn tailor as mere describer of species from its garments, without some end. — Respect good describers like Richardson.² |

- 53 The relations of numbers of species to genera &c &c can never be told without species being described. — but the permanent varieties in same country, must be distinguished from permanent varieties not in same country. —

- The traces of changes in forms of organs, will care little for species, except so far as wanting names to refer to, to those forms, when the termination of change occurs. — Those discovering the *formal* laws of the corelation of parts in individuals, will care little, whether the individual be species or variety. but to discover *physical*
 54 laws of such corelation, & changes of | individual organs, must know whether the individuals forms are permanent, all steps in the series, their relation to the external world, & every possible contingent circumstance. — The laws of variation of races, may be important in understanding laws of specific change. — When the laws of change are known — then primary forms may be speculated on, & laws of life, — the end of Natural History will be approximated to. —

Treating of the formal laws of corelation of parts & organs it may serve perfectly to |

- 55-56 *excised*.

¹ This reference to the correlation of parts shows that Darwin entertained it very early. As Professor S. Adler F.R.S., has suggested, it was probably because Darwin was over-impressed with the importance of this concept that he failed to think of the particulate nature of heredity.

² Sir John Richardson. Author of *Fauna Boreali-Americana; or the Zoology of the northern parts of British America*. London 1829-1837.

- 57 The Pipe-fish is instance of part of the hermaphrodite structure being retained in the male,¹ — far more than marsupial bones, & even more than mammae, which have given milk. — is secretion from Pidgeon stomach true milk. — Species are innumerable variations²

Every structure is capable of innumerable variations. as long as each shall be *perfectly* adapted to circumstances of *times*, & from persisting owing to their slow formation these variations tend to accumulate on any structure. |

- 58 L'Institut³ 1838, p. 384. List of fossil Mamm : from Poland &c. —

Three principles will account for all

(1) Grandchildren like grandfathers

(2) Tendency to small change especially with physical change

(3) Great fertility in proportion to support of parents |

- 59 December 2^d Lyell⁴ letter Mr Beck⁵ considers the characteristics of the Tropical Forms in shells are numerous species, numerous individuals, & *species of large size*. — consider this (Cetacea) with reference to my theory.

Babbage⁶ 2nd Edit. p. 226 — Herschel⁷ calls the appearance of new species the mystery of mysteries, ⁸ & has grand passage upon the problem. ! Hurrah — “intermediate causes” |

- 60 The Sexual system of the Cirrhipedes is the more remarkable from their alliance to Articulata, which are all truly bisexual.

Buckland's⁹ Reliqu : Diluv. says *Africa* only place where Elephant, Rhinoceros, Hippot., Hyaena & are found together. — Read this Work. —

Decb. 4th Why has the organization of fishes & Mollusca (& plants ???) been so little progressive (& insects. — Stonesfield¹⁰ ???) ! Agassiz¹¹ makes it wonderfully *changed* since Cretaceous period. whether progressive I know not. Have Mammalia ?? my theory certainly requires progression, otherwise |

61–62 excised.

¹ The male pipe-fish carries the developing eggs in a ventral pouch.

² The words “species are innumerable variations” are crossed out in the MS.

³ Carl Eduard von Eichwald. “Sur des Ossements fossiles de Mammifères trouvés en Pologne”, *L'Institut*, 1838, vol. 6, p. 384.

⁴ Charles Lyell. *Principles of Geology*, 5th edition, London 1837, vol. 3, p. 56.

⁵ Heinrich Henrichsen Beck.

⁶ Charles Babbage. *The IXth Bridgewater Treatise. A fragment*, London 1837. On p. 226 of the 1st edition is an Appendix “On the age of strata as inferred from the rings of trees embedded in them”, the 2nd edition of this work has not been consulted.

⁷ See Introduction, p. 157 above.

⁸ Here is the origin of this expression on the first page of the Introduction of the *Origin of Species*.

⁹ William Buckland. *Reliquiae Diluvianae ; or, Observations on the Organic Remains contained in Caves, Fissures, and Diluvial Gravel, and other Geological Phenomena attesting the action of an Universal Deluge*, London 1824, p. 170 : “... another interesting branch of inquiry connected with it is, whether any fossil remains of elephant, rhinoceros, hippopotamus, and hyaena exist in the diluvium of tropical climates; and if they do, whether they agree with the recent species of these genera, or with those existing species, whose remains are dispersed so largely over the temperate and frigid zones of the northern hemisphere.” On p. 21 Buckland refers to the modern hyaena living in Africa, and the elephant, rhinoceros, and hippopotamus were well known to be African. The statement that Africa is the only continent in which they all lived has not been traced.

¹⁰ The reference is to Mesozoic Mammals discovered in the Stonesfield Slate, published by William John Broderip, *Zool. Journ.* vol. 3, 1828, p. 408.

¹¹ Louis Agassiz. *Recherches sur les Poissons Fossiles*, Neuchâtel, 1833, tome 1, p. xxvii : “Les espèces de la craie appartiennent pour plus des deux tiers à des genres qui ont entièrement disparu.” From “Agassiz” to “I know not” inserted between lines,

- 63 Are the feet of water-dogs at all more webbed than those of other dogs. — if nature had had the picking she would make such a variety far more easily than man, — though *man's practised* judgment even without time can do much. — (yet one cross, & the permanence of his breed is destroyed).

- When two races of men meet, they act precisely like two species of animals. — they fight, eat each other, bring diseases to each other &c., but then comes the most
 64 deadly struggle, namely which have | the best fitted organization, or instincts (i.e. intellect in man) to gain the day. — In man chiefly intellect, in animals chiefly organization, though Cont. of Africa & West Indies shows organization in Black Race there gives the preponderance, intellect in Australia to the white. — The peculiar skulls of the men on the plains of Bolivia — study [?] fossil — & in Van Diemen's land — they have been exterminated on *principles* strictly applicable
 65 to the | universe — The range of man is not unlike that of animals transported by floating ice. — I agree with Mr Lyell,¹ man is not an *intruder* — : the geological history of man is as perfect as the Elephant if some genus holding same relation as Mastodon to man were to be discovered.

Man acts & is acted on by the organic and inorganic agents of this earth like every other animal. |

- 66 Would anyone raise an argument against my theory, should no fossil very distinct species of the Ornithorhynchus be found ; yet until man became cosmopolite, he would probably be confined in locality like Ornithorhynchus : since being cosmopolite, we do find his remains. — Lima — caves. — There being no fossils, the only way, that I can see to discover whether the parent of man was quadruped or bimanous,
 67 is to see, what | parts of structure abortive. — Remember my fathers² remark about the Bladder. —

The numbers of fatal diseases in mankind, the more valuable domesticated animals no doubt is owing to the tearing up of every hereditary tendency towards fatal diseases, & such constitutions only being cleared off by fatal diseases. — |

- 68 The value of a group does not depend on the number of the species : therefore man & monkeys have equal chance that progenitor was bimanous or quadrumanous. — What a chance it has been, (with what attendant organization, Hand & throat)
 69 that has made a man. — ³any monkey probably might, with | such chances be made intellectual, but almost certainly not made into man. — It is one thing to prove that a thing has been so, & another to show how it came to be so. — I speak only of the former proposition. — as in races of Dogs, so in species & in man.

December 16th The end of each volume of Whewells⁴ Induction History contains many most valuable references |

- 70 See if any law can be made out, that varieties are generally additions, & not abortive : with reference to the non-necessity of the so-called progressive tendency law. —

In animals analogy leads one to suppose that seminal fluid fluid (& not dry as in plants) therefore, great difficulty in crossing & *this most important obstacle to my*

¹ Charles Lyell. *Principles of Geology*, 5th edition, London 1837, vol. 3, pp. 68, 238.

² Robert Waring Darwin. The nature of the remark is unknown.

³ A square bracket is opened here ; it is not closed.

⁴ William Whewell. *History of Inductive Sciences*, London 1837.

theory¹ without the hermaphrodites mutually couple. — now how is it in Planaria,
 71 they couple (lowest terrestrial animals), — in shells? — | insects? — all !?!? — Worms?
 Barnacles, aquatic Crustaceans, & true hermaphrodites ² *It may be said that true
 hermaphroditism is a consequence of non-locomotion* — (contradicted by Plants) & as
 there are no fixed land animals, so there are [no] true hermaphrodites. — I suspect
 this rather effect of liquid semen, therefore animal life commenced in water!

It is a beautiful part of my theory, that domesticated races of organics are made
 by precisely same means as species — but latter far more perfectly & infinitely
 slower. — No domesticated animal is perfectly adapted to external conditions. —
 (hence great variation in each birth) from man arbitrarily destroying certain forms
 72 & not others. — Term *variety* may be used to *gradation* of change | which gradation
 shows it to be the effect of a gradation in difference in external conditions, — as
 in plant up a mountain — In *races* the differences depend upon inheritance & in
species are only ancient & perfectly adapted races

L'Institut³ 1838, p. 394. Rhinoceros tichorhinus in Paris basin. — its relation to
 African Species good observations⁴ larger than any living |

73-74 excised.

75 A Greyhound might be made almost without any relation to running hares as
 in Italian Greyhound⁵ — not so species every part of newly acquired structure is
 fully practical & perfected. Hence difference between *race* & *variety*?

Man picks the male, instead of allowing strength to get the day.

The fertility of Indian & Common Oxen, which one must think deserve the name
 of species, may be owing to the little fixity of organization, in the two races, owing
 to the domestication of both. — Now in the ass — there is little tendency to vary &
 hence offspring are hybrids. — |

76 Mr G. B. Sowerby⁶ showed me many land shells of the common species from one
 locality all left whorled. — He kept two to see if they would breed.

It is difficult to think of *Plato & Socrates*, when discussing the Immortality of the
 Soul as the linear descendant of mammiferous animal, which would find its place in
 the Systema Naturae. |

77 Looking at simple generation as being the action of two organs in one body, — or
 in two bodies, we can as well understand the necessity of a relation between the
 fluids of the two as in the grafting of trees. Mr. Knight⁷ makes this analogy between
 grafting & sexual union. — ⁸The similarity of child to parent appears to follow same

¹ The words in italics enclosed between square brackets.

² From "Barnacles" to "hermaphrodites" enclosed between square brackets.

³ "M. Valenciennes écrit qu'en faisant des fouilles sur la Place de la Grève pour les fondations des
 nouveaux Bâtimens de l'Hôtel de Ville, on a trouvé à 17 pieds au-dessous du sol, un humérus droit de
 Rhinocéros de l'espèce nommée par Cuvier *Rhinoceros tichorhinus*." *L'Institut*, 1838, tome 6, p. 394.

⁴ The words "good observations" were crossed out in the MS.

⁵ "as in Italian greyhound" inserted in pencil.

⁶ George Brettingham Sowerby. This was a century before the experiments were performed by A. E.
 Boycott, C. Diver, S. L. Garstang, and F. M. Turner: "The inheritance of Sinistrality in *Limnaea*
peregra", *Phil. Trans. Roy. Soc., B*, vol. 219, 1930, p. 51.

⁷ Thomas Andrew Knight. "Introductory Remarks relative to the objects which the Horticultural
 Society have in view", *Trans. Hort. Soc.*, vol. 1, 1820, (read 2 April 1805). On p. 4: "to use the phrase
 of Lord Bacon, the graft in all cases overruleth the stock, from which it receives *aliment*, but no motion."

⁸ A square bracket is opened here; it is not closed.

law in two of the *same* variety, as in two *varieties*, & this we might expect, as the difference between man & woman is indeed (independent of sexual differences) 78 a *variety*. The offspring of true | hermaphrodite would of course be like either, that is both parents, for they are one. —

The laws, therefore, of likenesses of fathers to children of mankind no doubt are applicable to likenesses, when species & races are crossed. — Now these laws are, that child may be either like father or mother, independently of its sex, or half way between, or somehow different from either : or like progenitors. — in some families all the children like mother & in some like father What is cause of this. — |

79 (Lord Morton's ¹law holds with *different species*, & individuals of *same species*. —) some races of man D'Orbigny² affect the common progeny more than others. — does this more refer to length of time that the resemblance is permanent, or the similarity at first births. — it is the latter only that one refers to in speaking of resemblances of children to their parents. —

Lord Morton's law³ cannot hold with fishes, & there are mule fishes & reptiles & those which have their eggs impregnated externally ; nor can it be a *necessary* concomitant with moths which can be impregnated externally. |

80 My view of every animal being Hermaphrodite — probably will receive illustration from domestication of Monoecious plants & abortion of others. —

? in hemi-hermaphrodite insects is it not easier to understand ?*perfect* ?? development of one sex on one side, then the addition of other organs, in which case the hermaphroditism would not be perfect. in Ox the amount of double sexual development is spread over |

81-82 *excised*.

83 is utterly untold, — what is added to the composition of the atom to make it alive, & how the laws of generation were impressed on it. —

Seeing that all vertebrates Müller's⁴ *Physiolog.* p. 24 can be traced to a germ, endowed with the vital principle, which gives rise to the sexual organs, different in each species, — & knowing from analogy, that all these big animals are descended from some one single stock, one is led to suspect that the birth of the species & individual

84 in their present forms, are closely related — By birth the | ⁵successive modifications of structure being added to the germ, at a time (as even in childhood) when the organization is pliable, such modifications become as much fixed, as if added to old individuals during thousands of centuries, — each of us then is as old as the oldest animal,⁶ have passed through as many changes as has every species. — |

¹ Lord Morton. "A communication of a singular fact in Natural History", *Phil. Trans. Roy. Soc.* vol. III, 1821, p. 20'. Lord Morton's "law" is the supposed transmission through the dam to the progeny of characters of another sire which the dam does not possess.

² Alcide Dessalines d'Orbigny. "L'homme américain (de l'Amérique méridionale), considéré sous les rapports physiologiques et moraux". *Comptes rendus Acad. Sci.*, Paris, tome 7, 1838, p. 568.

³ Lord Morton's "law" could not be expected to hold in cases where the young undergo development externally to the mother as free and independent larvae.

⁴ Johannes Müller. *Elements of Physiology*, translated from the German by William Baly, London 1839, vol. I, p. 24 : — "organic beings do not subsist merely by virtue of accidental combination of elements; but, on the contrary, by the vital force inherent in them . . . The germ is "potentially" the whole animal." This reference is enclosed between square brackets.

⁵ The word "the" is repeated here.

⁶ The words "is as old as the oldest animal" were crossed out by Darwin in MS. This is an early attempt by Darwin to express anatomy in terms of embryology.

85-88 excised.

89 Jan. 6th [1839] The rudiment of a *tail* shows man was originally *quadruped*.
Hairy — could move his ears

The head being six metamorphosed vertebra,¹ the parents of all vertebrate animals must have been like some molluscos bisexual animal with a vertebra only & no head—!!

Handwriting is determined by most complicated circumstances, as shown by difficulty in forging. yet handwriting said to be hereditary, shows well what minute details of structure of [*recte* are] hereditary |

90 Athenaeum² 1839, p. 36. — a crustaceous animal is mentioned which inhabits the Pinna of Rio Janeiro (like some Mediterranean species). — might these fertilise other shells, as insects do flowers. — Mem. Spallanzani³ experiments showing how little of the spermatie fluid fertilized spawn of frogs. —

*Annals of Natural History*⁴ (p. 225, 1838) account of metamorphosis in the young of Syngnathus. curious as showing generality of law even in fish: ditto p. 236 on Hybridity in ferns.⁵ — ditto p. 250 — speaking of the terrestrial mollusca of Morocco, Mr Forbes⁶ says the Fauna (near Oran) approach in character to Canary Isl^a. — i.e. Canary Isl^a approaches *more* to neighbouring coast of Africa, than to other parts of that |

91-94 excised.

95 The enormous *number* of animals in the world depends of their varied structure & complexity. — hence as the forms became complicated, they opened *fresh* means of adding to their complexity. — but yet there is no *necessary* tendency in the simple animals to become complicated although all perhaps will have done so from the new relations caused by the advancing complexity of others. — It may be said, why should there not be at any time as many species tending to dis-developement (some probably always have done so, as the simplest fish), my answer is because, if we begin with the simplest forms & suppose them to have changed, their very changes
96 tend to | give rise to others. — Why then has there been a retrograde movement in Cephalopods & fish & reptiles? — supposing such be the case, it proves the law of

¹ When Darwin wrote, the accepted view was that of Goethe and Oken that the vertebrate skull was composed of a number of fused vertebrae. This relic of transcendental anatomy, to which Richard Owen also subscribed, was destroyed by T. H. Huxley in 1858 (G. R. de Beer, *The Development of the Vertebrate Skull*, Oxford 1937).

² *Athenaeum*, 1839, 12th January, p. 36. Miscellanea. *New Crustacea*. "A surgeon of the French navy, M. Mitre, just arrived at Brest, among several new and interesting objects of natural history, has brought a new Maclura, which he found at Rio de Janeiro in the Pinna nobilis. The existence of this Crustacean in the seas of the New World is a curious fact in the geography of zoology, for since the time of Aristotle, it has only been found in the Mediterranean."

³ Lazzaro Spallanzani. *An Essay on Animal Reproduction*, London 1769. "Of the existence of the tadpoles in eggs before fecundation". On page 46: "... could not the eggs of frogs be fecundated artificially, by sprinkling them before fecundation, with the liquor extracted from the spermatie vessels of the male?"

⁴ B. F. Fries. "Metamorphosis observed in Syngnathus lumbriciformis", *Ann. Nat. Hist.*, vol. 2, 1838, p. 225: "... the young of this beautiful species at their development from the egg have the entire tail covered with a fin-like membrane and possess pectoral fins. These at a subsequent unknown period are thrown off in a way similar to that of the larvae of frogs rejecting their tails."

⁵ M. Martens. "Hybridity in Ferns", *Ann. Nat. Hist.*, vol. 2, 1838, p. 236: M. Martens observed in the Botanical Garden of Louvain, a fern which he regarded as a hybrid between *Gymnogramma calomelanos* and *G. chrysophylla*."

⁶ Edward Forbes. "On the Land and Freshwater Mollusca of Algiers and Bougia", *Ann. Nat. Hist.*, 1838, vol. 2, p. 250: "Oran (near Morocco), where the Fauna of Barbary assumes a different aspect, approximating to that of the Canaries on the one hand, and to that of Spain on the other."

developement in partial [*recte* ? particular] classes is far from true. — I doubt not if the simplest animals could be destroyed, the more highly organized would soon be disorganized to fill their places. —

The geologico-geographico changes must tend sometimes to augment & sometimes to simplify structures. Without enormous complexity, it is impossible to cover *whole* surface of world with life. — for otherwise a frost if killing the vegetables in one quarter of the world would kill all, — & the one herbivorous & its one carnivorous
 97 devourer ; it is | quite clear that a large part of the complexity of structure is adaptation, though perhaps difference between jaguar & tiger may not be so. — Considering the Kingdom of nature as it now is, it would not be possible to simplify the organization of the different beings, (all fishes to the state of the *Ammocoetus*, Crustacea to —? &c) without reducing the number of living beings — but there is the strongest possible [tendency?] to increase them, hence the degree of developement is either stationary or more probably increases. — |

98 Jan. 29th. Uncle John¹ says he feels sure, that the reason people send for their seeds to London is that people in the southern Counties have whole fields, some for cauliflower &c. — Uncle John believes one single turnip in a garden is sufficient to spoil a bed of Cauliflowers. — (How curious it would be to make enquiries of some of the great seed-growers —). —

Feb. 24th. Monoceros, which Sowerby² says is an American form, has several
 99 species in my | fossils —³ If cases of one variety in upper part of bed & another in lower is very rare, the conclusion will be that our greatest formations have been deposited in a period (say 10,000 years) which is sufficient only to have most slightly modified organic forms. — We know not rate of deposition has been equal even in one bed, much less in alternating strata of sand & limestone &c. &c. — |

100 L'Institut 1838,⁴ p. 290 — admirable paper on geographical distribution of Crustacea. — (I forget whether I have already referred to it — also on spermatric animalcules in *Musci frondosi*, et hepatici, — in *Chara*, in *Marchantia* & *Hypnum*. —

Prof : Don⁵ would have known the Composites of Galapagos were South American. — several cases of species peculiar to separate islets. —

March 5th. Lyell⁶ says fossil shells from North America, Scotland, Uddevalla many species same. & northern forms — & the American ones & European — agree
 101 very much | closer, than the present ones, which according to Beck⁷ are different. — Subsidence of Greenland — case of splitting of two regions — are there any cases of union of two regions in modern times. — this would depend on negative evidence of fossil remains, & therefore not to be trusted. — Lyell tells me, on authority of Beck that Hooded crow & Carrion crow have in Europe different ranges — latter not going |

¹ John Hensleigh Allen of Cresselly (1769–1843).

² George Brettingham Sowerby. *The Zoology of Captain Beechey's Voyage*, London 1839, p. 161 : "Monoceros crassilabrum Lam.; recent at Valparaiso, &c. Monoceros crassilabrum var.; recent at Valparaiso &c". This note is not by Sowerby, but is included in the Section immediately following his "Observations by the Editor".

³ A square bracket is opened here : it is not closed.

⁴ Henri Milne Edwards. "Géographie Zoologique. M. Milne Edwards lit l'extrait d'un mémoire sur la distribution géographique des Crustacés", *L'Institut*, tome 6, 1838, p. 290.

⁵ George Don (jun.) had collected plants in S. America.

⁶ Charles Lyell. Presumably personal communication.

⁷ Heinrich Henrichsen Beck. Personal communication to Lyell.

102 north of the Elbe, — yet they meet in one wood in Anhalt & there every year produce hybrids — now this is independent good case, but very odd since these crows are mixed in England — for I presume Carrion Crow is found in Edinburgh. — Why does Fleming¹ consider them varieties & what says Jenyns² to it? — In argument of origin of Wolf, difference of mind is most relied on, |

103-104 *excised*.

105 forms. — on southern flanks of Alps, many peculiar plants on single mountains, though these are connected with other mountains laterally. —

Owen.³ Fossil Mammalia p. 55 talks of *Tapirus* American form found in Eocene beds of Paris.

Lyell⁴ has remarked species never reappear when once extinct. Lyell's argument about Isl^d. neighbours, formed in the Tertiary epoch like Sicily,⁵ not having species, if true, important on my view. — |

106 March 9th Is there any relation between the fact that different species produce abundantly infertile hybrids, & the fact that old varieties do not so much affect first race, as it does indelibly the many subsequent ones.

My views,⁶ V. p. 103 would lead me to think that a variety of one species would cross easier with 2nd species, than two perfect species; but facts of grouse, & pheasant, & hooded crow goes against this, & *wild* hybrid plants. |

107 If many wild animals were crossed, there would probably be perfect series, from physical impossibility to unite to perfect prolificness — (a series might be obtained)⁷ but the intervention of domesticated i.e. new varieties destroys the appearance of this series & makes me think that one large body of varieties are fertile & make mongrel, & other great series quite otherwise & make no *true* hybrids — but this is false, give instance of series from wild animals & plants⁸ |

108 Mr. Mark⁹ has some nephews who are *astonishingly* like to some distant cousins, the nearest blood being a *great great* grandfather. — Little Miss Hibbert case of kindness coming out more than in mother or indeed grandmother: what is in S.S. parentage? —

¹ John Fleming. *A History of British Animals*, Edinburgh 1828, p. 87: "Corvus corone . . . is this species different from the Hooded Crow?"

² Leonard Jenyns. *A Manual of British Vertebrate Animals* Cambridge 1835. On pp. 145 and 146 *Corvus corone* the Carrion Crow and *C. cornix*, the Hooded Crow are listed as separate species.

³ Richard Owen. *The Zoology of the Voyage of the Beagle*, Part I, Fossil Mammalia, London 1840, p. 55: "It is well known how unlooked-for and unlikely was the announcement of the existence of an extinct quadruped entombed in the Paris Basin, whose closest affinities were to a genus, (*Tapirus*) at that time, regarded as exclusively South American."

⁴ Charles Lyell. It seems that Darwin must have obtained verbally from Lyell the view expressed subsequently in his *Elements of Geology*, 2nd edition, London 1841, vol. 1, p. 200: "It appears, that from the remotest periods there has been ever a coming in of new organic forms, and an extinction of those which pre-existed on the earth; some species have endured for longer, others for a shorter time; while none have ever re-appeared after once dying out."

⁵ Charles Lyell. *Principles of Geology*, 5th edition, London 1837, vol. 3, p. 444: "We have seen that a large portion of Sicily has been converted from sea to land since the Mediterranean was peopled with the living species of Cetacea and zoophytes. The newly emerged surface, therefore, must, during this modern zoological epoch, have been inhabited for the first time by the terrestrial plants and animals which now abound in Sicily." The words "formed" to "Sicily" are in pencil.

⁶ The reference is to MS. page 103 of this Notebook, which Darwin excised.

⁷ The words "a series might be obtained" were crossed out by Darwin.

⁸ The words "give" to "plants" enclosed between square brackets.

⁹ Mr. Mark. Dr. Robert Darwin's coachman at Shrewsbury.

Wonderful as is the possession of voice by Man we should remember, that even birds can imitate the sounds surprisingly well. —

In early stages of transmutations, the relations of animals & plants to each other would rapidly increase, & hence number of forms, once formed, would remain
 109 stationary, hence all present types are ancient | according to my views of *all* plants, being occasionally dioecious; & really dioecious plants being effect of abortion of one sex. — Linnean class Dioecia & Monoecia ought to be preeminently artificial. —

Would not subsidence of Greenland render climate less extreme (& so account for descent [*recte* ascent] of snow line there & then & there only: as stated by Capt. Graah)¹ & break up N. American Conchology from European, & the climate being now less extreme than before, arctic forms would retreat: effect on snow of arctic climate in far north regions? Arctic forms have travelled S. |

110 From the analogy of the animal kingdom I should suppose, — that the pollen of crab would POSSIBLY (no, for pollen of any kind would fertilize it)² fertilize an apple somewhat more readily than other apples, he probably would more indelibly stain offspring — it would not *reach* one apple sooner than that of another apple. only effect produced would be different. — same way one variety of dog does not prefer other, but produces greater effect on offspring — |

111 Mr. Herbert³ says p 347 Amaryllidaceae Plants do not become acclimatized by crossing, or by *accidental production of seedling with hardier constitution*. — Now Sir J. Banks⁴ says *Zizania* in 16 generations did become acclimatized, & says Laurels have not been so (which is case adduced by Herbert)⁵ because not reared by seedlings. Now my principle does not apply to any plant reared artificially, & only very partially to the *Zizania*s in Sir J. ponds — my principle being the destruction of all the less
 112 hardy ones & the | preservation of *accidental* hardy seedlings: (which are confessed to by Herbert)⁶ to sift out the weaker ones: there ought to be no weeding or encouragement, but a vigorous battle between strong & weak.

¹ Captain Graah; in Charles Lyell's *Principles of Geology*, 5th edition, London 1837, vol. 2, p. 302: "The observations alluded to were made by Captain Graah during a survey of Greenland in 1823-24; and afterwards in 1828-29."

² The words in this bracket inserted subsequently.

³ William Herbert. *Amaryllidaceae*, London 1837, p. 347: "it does not appear that in reality any plant becomes acclimated under our observation, except by crossing with a hardier variety, or by the accidental alteration of constitution in some particular seedling." It will be noticed that Darwin's note on this passage is inaccurate by substituting "or" for "except".

⁴ Sir Joseph Banks. "Some hints respecting the proper mode of inuring tender plants to our climate," (read December 3rd, 1805), *Trans. Hort. Soc.*, vol. 1, 1811, p. 21. On p. 22: "In the year 1791, some seeds of *Zizania aquatica* were procured from Canada, and sown in a pond at Spring Grove, near Hounslow; it grew, and produced strong plants, which ripened their seeds: these seeds vegetated in the succeeding spring, but the plants they produced were weak, slender, not half so tall as those of the first generation, and grew in the shallowest water only; the seeds of these plants produced others next year, sensibly stronger than their parents of the second year. In this manner the plants proceeded, springing up every year from the seeds of the proceeding one, every year becoming stronger and larger, and rising from deeper parts of the pond, till the last year, 1804, when several of the plants were six feet in height, . . . Here we have an experiment which proves, that an annual plant, scarce able to endure the ungenial summer of England, has become in fourteen generations, as strong and as vigorous as our indigenous plants are, and as perfect in all its parts as in its native climate."

⁵ William Herbert. *op. cit.* p. 347: "although we are told that laurels were at first kept in hothouses in this country, it was not that they were less capable of supporting our seasons than at present, but that the cultivators had not made full trial of their powers of endurance."

⁶ William Herbert. *op. cit.* p. 347; see above.

March 11th. Yarrell's¹ law must be partly true, as enunciated by him to me, for otherwise breeders who only care for first generations, as in horses, would not care so much about breed. — what can however be more striking, about indelibility, 113 than the | number of good race-horses which *Eclipse*? has begotten. Walker² attributes this to effect of male sex on locomotive system.

I am bound to insist honestly that the *sudden* change from Primrose to cowslip is great difficulty (I should doubt if wild species ever found like short-tailed cat or dog has been without recurrent tendency in external conditions) sudden loosing [losing] of horns. — I do not believe this nature's plan. —

Whether we can or not trace history of first appearance of varieties of domesticated animals, yet as we know how many plants have been produced (look at the Dahlias we may infer it in animals) — Azara³ gives account of production of hornless cattle, ? & others? — |

114 March 12th. It is difficult to believe in the dreadful but quiet war of organic beings going on [in] the peaceful woods & smiling fields. — we must recollect the multitude of plants introduced into our gardens (opportunities of escape for foreign buds & insects) which are propagated with very little care, — & which might spread themselves as well as our wild plants, we see how full nature, how finely each holds its place. — When we hear from authors (Ramond⁴ Hort. Tranact. vol. 1, p. 17 Append) that in the Pyrenees that the |

115-116 excised.

117 Poet Cowper⁵ describes his tame Hares attacking a sick one like Chillingham bulls are described. — His three have had VERY different dispositions: this is important as showing small variations in offspring of wild animals — *grateful* & intelligent. —

The theory that all animals have sprung from few stocks, does not bear the least on ancient generic forms. — the animals in Eocene period could not have been direct parents of any of ours, — even if extinction is denied. — it will not account for all species even if it will for all [*recte* some]. — |

118 Varieties are made in two ways — local varieties when whole mass of species are subjected to same influence, & this would take place from changing country: but greyhound race-horse & poulter Pidgeon have not been thus produced, but by

¹ William Yarrell who believed that in a cross the oldest variety had the greatest influence on the characters of the mongrel offspring. cf. Darwin's Second Notebook on Transmutation of Species, MS. pp. 1 and 121.

² Alexander Walker. *Intermarriage*, London 1838, "by regulating the relative youth, vigour and voluntary power of sire and dam, either may be made to give to progeny the voluntary and locomotive systems, and the other the sensitive and vital systems; though, if they be well conformed, it is preferable that the sire should give the former and the dam the latter, as being the systems in which naturally they respectively excel."

³ Félix d'Azara. *Essais sur l'histoire naturelle des quadrupèdes de la province du Paraguay*. Paris ix (1801), tome 2, p. 371: "Dans le district des Corrientes, naquit en 1770 un Taureau écorné ou sans cornes. Il a propagé sa race dans ces pays-ci, et il faut observer à cet égard que les petits d'un Taureau sans cornes en sont privés, quoique la mère ait des cornes, et que les petits d'un père à cornes en ont aussi, quoique la mère en soit privée."

⁴ Louis-Elizabeth Ramond de Carbonnières. "On the vegetation of high mountains", translated by Richard Anthony Salisbury (read 2nd April, 1811), *Trans. Hort. Soc.*, vol. 1, 1812, Appendix p. 15. The passage in question on p. 17 reads: "Thus in the Swiss Alps, and Pyrenees, trees cease to grow at about 2400 or 2500 metres of actual elevation, as they do about the 70th degree of north latitude."

⁵ William Cowper. "Unnoticed properties of that little animal the hare". *Gentleman's Magazine*, vol. 54, part I, 1784, p. 412. On p. 413: "like many other wild animals, they persecute one of their own species that is sick." Their names were "Puss", "Tiney", and "Bess".

training, & crossing & keeping breed pure — & so in plants *effectually* the offspring are picked & not allowed to cross. — Has nature any process analogous — if so she can produce great ends — But how — even if placed on Isl^d. if &c &c — make the difficulty apparent by cross-questioning¹ — Here give my theory. — excellently true theory |

119-126 excised.

127 be thus put, shall we give up whole system of transmut. or believe that time has been much greater, & that systems are only leaves of whole *volumes*. —

The fact of tumbling pigeons, — flying high all together & then tumbling far more wonderful than hereditary *ambling* horses.

Whether the body of parent be altered, that in the *Nisus formativus* (what does Muller² call it) succeeds in altering form of body, or whether it merely has tendency (as effects of cultivation or successive generations of plants) to do so, the effects are equally handed to offspring. — |

128 Whewell's³ anniversary address 1839, p. 9 talks about fossil Infusoria becoming extinct not so soon as other forms. — p. 36 speaking about the controversy on *Didelphys* says⁴ "If we cannot reason from the analogies of the existing to the events of the past world, we have no foundation for our Science".⁵ — but experience has shown we can & that analogy is sure guide & my theory explains why it is sure guide. — |

129-132 excised.

133 the stigma retains its power. —

R. Brown⁶ found the masses of pollen of *Asclepias* placed on *Orchis* (so very different) that the granules exerted their tubes; now Mr. Herbert⁷ has shown that stigma swells, when pollen even most remote is put to it. —

April 6th "Dr Edwards⁸ on the Influence of Physical agents" translated by Dr

¹ These seven words inserted between lines.

² Johannes Müller. *Elements of Physiology*, translated from the German by William Baty, London 1839, 2nd edition, on p. 395: "... both organs and nerves are produced by the same power, the *nisus formativus*, which resides undivided in the germ."

³ William Whewell. "Address to the Geological Society, delivered at the Anniversary, on the 15th of February, 1839", *Proc. Geol. Soc. Lond.*, vol. 3, 1839, p. 61. On p. 63: "Of about eighty species of fossil Infusoria which have been discovered in various strata, almost the half are species which still exist in the waters: and thus these forms of life, so long overlooked as invisible specks of brute matter, have a constancy and durability through the revolutions of the earth's surface which is denied to animals of a more conspicuous size and organization." The page references given by Darwin must refer to the pagination of a reprint.

⁴ William Whewell. *Ibid.* vol. 3, p. 89.

⁵ While most of the credit for impressing Darwin with the principle of uniformity is rightly given to Lyell, this statement of Whewell's views should not be overlooked.

⁶ Robert Brown. "On the organs and mode of fecundation in Orchideae and Asclepiadeae", *Trans. Linn. Soc. Lond.*, vol. 16, 1833, p. 685. On page 728: "Pollen masses of *Asclepias purpurescens* being applied to the stigma of *Epipactis palustris*, and immersed in its viscid secretion, the dehiscence, contrary to expectation, not only took place, but even more speedily than usual, that is within twenty-four hours. Some of the grains were also found discharged from the mass unchanged, while others, both discharged and still inclosed, had begun to produce tubes."

⁷ William Herbert. "On the Production of Hybrid Vegetables; with the Result of many Experiments made in the Investigation of the Subject", *Trans. Hort. Soc.*, vol. 4, 1832, p. 15. On page 24: "I touched its [Azalea] stigma therefore with the dust of *Rhododendron Catawbiense*. The capsules swelled, ..."

⁸ William Francis Edwards. *On the Influence of Physical Agents*, translated by Hodgkin, p. 54. This translation has not been accessible, but in the original work, *De l'influence des agents physiques sur la vie*, Paris 1824, the passage in question is on page 111: "M. Cuvier, qui a fait de belles recherches sur ces animaux, a constaté que l'axolotl avait la structure d'une larve de salamandre; que la sirène et le protégé devaient constituer des espèces de genres différens, et que les poumons de ce dernier étaient dans un état presque rudimentaire."

Hodgkin p. 54 The axolotl, siren & Proteus, affinity to tadpoles, p. 210, shows¹ that the action of light is concerned with the developement of form; but that tadpole
 134 increased in size. — | Now the Proteus anguiformis he remarks lives in dark caverns of Carniola

p. 112. Man² "standing alone in the gift of intellect, he resembles other mammalia in the effects produced on organization by *physical agents*."

p. 466. Many facts given of high temperature at which fish &c can live.³ —

Lyell⁴ says that naked cuttle fish now bear a very large proportion to other mollusca
 135 in cold parts of sea, like Cetacea, although the | Cephalopoda seem to have decreased since earliest times —

Apterix has a most perfect Struthio head pulled out, yet feathers retain character? If separation in horizontal direction is far more efficient in making species, then time, (as cause of change) which can hardly be believed, then, uniformity in geological formation intelligible.

No, but the wandering & separation of a few probably would be most efficient in producing new species: also one being reduced in numbers, but not so much then, because circumstances.⁵ |

136 Cestracion. Port Jackson shark. Owen⁶ thinks Australia part of old World.

It may be said that wild animals will vary according to my Malthusian views, within certain limits, but beyond them not, — argue against this — analogy will certainly allow variation as much as the difference between species, — for instance pigeons — : then comes question of genera. It certainly appears that swallows have decreased in numbers, what cause ?? |

137 Seeing the beautiful seed of a Bull Rush I thought, surely no "fortuitous" growth could have produced these innumerable seeds, yet if a seed were produced with infinitesimal advantage it would have better chance of being propagated & so &c. The greatest difficulty to my theory, is same type of shells in oldest formations: — The Cambrian formations do not however, extend round world. Quartz of Falkland. — Old Red Sandstone — Van Diemen's land — Porphyries of Andes. — |

138 A familiar history of birds by the Rev. E. Stanley⁷ vol. 1, p. 72. — Goldfinches placed near, but not in sight of each other will sing till they drop off their perch. — p. 101 — Kingfisher in northern parts of England stationary, in southern stays only winter. — Jays & chaffinches sometimes migratory.⁸

¹ William Francis Edwards. *Ibid.* p. 400: "Ainsi ces deux séries d'expériences concourent à prouver que la présence de la lumière solaire favorise le développement de la forme, et servent à faire distinguer ce genre de croissance de celui qui consiste dans l'augmentation des dimensions générales du corps."

² William Francis Edwards. *Ibid.* p. 230: "Unique par son intelligence, il se rapproche des mammifères par les nécessités de la vie, communes à tous les êtres qui ont une organisation semblable."

³ William Francis Edwards. *Ibid.* p. 601: "Tableau de l'influence de la température sur la vie des poissons . . . " *et seq.*

⁴ Charles Lyell. Presumably personal communication.

⁵ This paragraph inserted at the bottom of the page.

⁶ Richard Owen. Presumably personal communication.

⁷ Edward Stanley. *A Familiar History of Birds*, London 1814, vol. 1 p. 72: "Goldfinches . . . are put in small cages, with wooden backs, and placed near to, but so that they cannot see, each other: they will then raise their shrill voices, and continue their vocal contest till one frequently drops off its perch, perfectly exhausted. . . ."

⁸ Edward Stanley. *Ibid.* p. 101: ". . . the Kingfisher, which in the northern parts of England may be seen all the year round, on some parts of the southern coasts only makes its appearance in October in considerable numbers, and as regularly departs in the following spring. Few would suspect our constant and lively companions, the Jays and Chaffinches to be at times travellers, but so it is; there is proof of the fact."

p. 103. Turtles finding their way to the Caymans from Honduras good case of migrating shows my theory insufficient.¹ —

p. 120. An Eagle is said to have been seen carrying a lamb two miles towards the Morne mountains, it² |

139-140 excised.

141 May 4th The Brussels Sprout returning suddenly to type when brought back to home (& yet all the varieties of Brassica certainly not becoming Brussels Sprouts) & yet in all probability the Brussels Sprout was slowly formed, — is analogous to Primrose & Cowslip *suddenly* changing into each other, & depends on character of antecedent races. —

if it shall be difficult to show that the fixity of characters from antiquity prevents their variation, which is not improbable as Mr. Herbert³ does not seem to recognize any difference in crossing between varieties & species, yet the amount of [blank] |
142 may depend on many circumstances, time of domestication (see Wi[l]kinson⁴ on dogs of Egypt & Cuvier⁵ on mummies).

NB TIME is *element* in change, as in *Dahlias*⁶ all much varied breeds both plants & animals have long been subject to domestication. — The constitution of some may resist the means man can offer of changes, — as desert or rock plant probably would do — or be with difficulty be kept alive. — Nevertheless much probably depends on circumstances favouring the reappearance of characters formerly possessed or rather the parents having passed through many changes. — |

143 It is very important Mr Herbert's⁷ fact about the hybrids (mentioned in letter to Henslow) fertilizing each other, better than the pollen of same flower, — as it tends to show my view of infertility⁸ of hybrids with parent species false, which makes it determined by a facility in returning to old type.

Mr Herbert⁹ showing the extreme facility of crossing in plants proves how much depends on instincts in animals. — yet the existence of wild close species of plants

¹ Edward Stanley. *Ibid.* p. 103: " . . . it has been observed in turtles, which cross the ocean, from the Bay of Honduras to the Cayman Isles, near Jamaica, a distance of 450 miles, without the aid of chart or compass, and with an accuracy superior to human skill; for it is affirmed, that vessels which have lost their reckoning in hazy weather, have steered entirely by the noise of the turtles in swimming."

² Edward Stanley. *Ibid.* p. 120: " . . . in Ireland a large Eagle was seen to alight and take up a lamb, and carry it away in a straight direction towards the high range of the Morne mountains."

³ William Herbert. *Amaryllidaceae*, London 1837, p. 17: "It seems to me utter waste of words to argue whether vegetables, if of one genus or identical kind, are species or varieties." p. 341; "In fact there is no real or natural line of difference between species and permanent or descendible variety."

⁴ John Gardner Wilkinson. *Manners and Customs of the ancient Egyptians*, London 1837, vol. 3, p. 32.

⁵ Georges Cuvier. "Sur l'Ibis des anciens Egyptiens", *Annales du Muséum national d'Histoire Naturelle*, tome 4, an XII (1804), p. 116. On page 118: "J'ai partagé l'erreur des hommes célèbres que je viens de nommer, jusqu'au moment où j'ai pu examiner par moi-même quelques momies d'ibis."

⁶ From "NB" to "*Dahlias*" enclosed between square brackets.

⁷ William Herbert. *cf. Amaryllidaceae*, London 1837, p. 342: "Subsequent experiments have confirmed this view to such a degree as to make it almost certain that the fertility of the hybrid or mixed offspring depends more upon the constitutional than the closer botanical affinities of the parents."

⁸ The initial *i* of "infertility" is crossed out.

⁹ William Herbert. "On the production of Hybrid Vegetables; with the result of many Experiments made in the Investigation of the Subject", *Trans. Hort. Soc.*, vol. 4, 1832, p. 15: " . . . I am, however, satisfied, from the progress I have already made, that several plants, which I have raised, are not only, in the fair sense of the word, hybrid, but also fertile; and if they should perpetuate themselves by seed, without reverting to the form of either parent, they will be entitled to be considered by the Botanists as distinct species. . . . and I doubt very much whether such a multiplication of distinct species may not also have taken place in the animal and insect tribes; but, to produce an intermixture between species that may have so diverged, the will of the animal must consent, while that of the plant need not be consulted."

144 shows there is tendency to prevent the crossing. — | in animals where there is much facility in crossing there comes the impediment of instinct —

The possibility of rearing by seeds holyoaks¹ (how far is this so) shows either there is not so much crossing as I think, or that these varieties have become as fixed as species, & prefer their own pollen to that of other variety. —

Elizabeth² & Hensleigh³ seemed to think it absurd that the presence of the Leopard & Tiger together depended on some nice qualifications each possess, & that tiger springing so much further would determine his preservation — if killed by some other animal then that quality which saved him, would be the one encouraged. — |

145 Wilkinson's⁴ Manners & Customs of the Ancient Egyptians vol. III p. 33 — They have several breeds of dogs — like greyhound — fox-dog — turnspit & two other kinds.

It seems absurd proposition, that every budding tree, & every buzzing insect & grazing animal owes its form, to that form being the one *alone* out of innumerable other ones, which has been preserved. — but be it remembered how little part of the grand mystery is this. — the law of growth, that which changes the acorn into the oak. — In short all which nutrition, growth & reproduction is common to all living beings. vide Lamarck⁵ vol. II p. 115 four laws.⁶ |

146 Who can say, how much structure is due to external agency, without final cause either in present or past generation — thus cabbages growing like Nepenthes — cases of pigeons with tufts &c. &c. here there is no final cause yet it must be effect of some condition of external circumstances, results of complicated laws of organization ;

147 as we see there strange plumage in pigeons yet no change of habits, so no | corresponding change in Birds of Paradise. — All that we can say in such cases is that the plumage has not been so injurious to bird as to allow any other kind of animal to usurp its place — & therefore the degree of injuriousness must have been exceedingly small. — This is far more probable way of explaining, much structure, than attempting anything about habits —

No one can be shocked at absence of final cause. Mammæ in man & wings under united elytra |

148 The law of generation is only modification, though important one of growth. Lamarck⁷ vol. II, p. 120 — Observe it commences only when growth stops. —

¹The reference is to hollyhocks. cf. William Herbert. *Amaryllidaceae*, London 1837, p. 366.

²Sarah Elizabeth Wedgwood (1793–1880), eldest sister of Darwin's wife.

³Hensleigh Wedgwood (1803–1891), brother of Darwin's wife This paragraph is inserted at the bottom, of the page.

⁴John Gardner Wilkinson. *op. cit.* vol. 3, p. 32 : "The Egyptians had several breeds of dogs, some solely used for the chase, others admitted into the parlour, or selected as companions of their walks ; and some, as at the present day, selected for their peculiar ugliness."

⁵Jean-Baptiste de Lamarck. *Philosophie Zoologique*, Paris 1809, tome 2, p. 115 : "Les facultés communes à tous les corps vivans, c'est-à-dire, celles dont ils sont exclusivement doués, et qui constituent autant de phénomènes qu'eux seuls peuvent produire, sont : ° De se nourrir . . . 2° De composer leur corps . . . 3° De se développer et de s'accroître . . . 4° Enfin, de se régénérer eux-mêmes, . . . (This passage appears on page 106 of tome 2 of the reprint of 1873.)

⁶From this paragraph to MS. page 152 inclusive the text is written in pencil.

⁷Jean-Baptiste de Lamarck. *Ibid.* tome 2, p. 120 : "cette faculté de reproduction ne commence à jouir de son intensité que lorsque la faculté d'accroissement commence à diminuer : on sait assez combien l'observation confirme cette considération ; puisque les organes reproducteurs (les parties sexuelles), dans les végétaux comme dans les animaux, ne commencent à se développer que lorsque l'accroissement de l'individu est sur le point de se terminer." (1873 reprint tome 2, p. 110.)

- Spallanzani's¹ facts in connection with buds. — They differ from possibility of con-
course of two individuals, & the action *always* of two organs — instead of one part
as in producing bud. — Fewer of the *lately acquired* peculiarities are transmitted
than by growth — generation ; it is doubtful whether any are transmitted, for the
changes in fruit trees, mentioned by Mr. K[night]² may be caused by the diversity of
stocks, on which they are grafted.³ No⁴ & more of the effects of conditions on the
propagating constitution, but not structure of the parents. — Thus would a cut |
149 tree vary if planted in rich soil. I presume not, but its seeds, I presume probably
would — at least the experiment of the carrot seems to show this. — This would be
a curious law. Certainly Australian Dog is not affected by domestication, yet off-
spring are. — if Australian Dog could bud, analogy tells us, offspring would be similar
to first form. — The great effect of conditions on offspring, but not on individuals is
very curious & important.⁵ — |
- 150 The existence of "law of organization" had better be shown. soil on colour of
flowers, Hydrangea — black bullfinches — & all varieties must be presumed to be
result of such laws. — The effect of one part being greatly developed on another,
must not be overlooked. — It makes fourth cause or law of change. — The weakest
part of my theory is the absolute necessity, that every organic being should cross
151 with | another — to escape it in any case we must draw such a monstrous conclusion,
that every organ is become fixed & cannot vary — which all facts show to be absurd. —
As there are plants in northern latitudes, which are generated by buds alone or
roots, & never flower, so there may be animals as Coralline, or others which only
generate once in a thousand generations. — any amount of generation may take
place by gemmation, my theory will not admit this, now that tulips break by cultiva-
152 tion, can a form become permanent? because its very essence is | that little change
is produced. —

The fact just alluded to of *Northern* flowers, throws enormous difficulty in the way
of Mr. Knights⁶ theory, without seeds are freshly transported — throw over this
theory, & the sexual reproduction of species may stop for any number of generations
— Gorse in Norway, which never flowers !! — How did it get there?⁷ |

- 153 According⁸ to the above suggestion my theory would require, that individuals
propagated by gemmation should be absolutely similar ; all the gorse in Norway
ought to be thus characterised study von Buch.⁹ Now Mr Knight¹⁰ statement about

¹ Lazzaro Spallanzani. It seems that the reference is to Spallanzani's work on regeneration-buds,
described in *An Essay on Animal Reproduction*, London 1769.

² Thomas Andrew Knight. "On the want of permanence of character in varieties of fruit, when propa-
gated by graft and buds," *Trans. Hort. Soc.*, vol. 2, 1822, p. 160 : "few, if any, varieties of fruit can, with
strict propriety, be called permanent, when propagated by buds or grafts."

³ The words "it is doubtful" to "grafted" inserted between lines in ink.

⁴ The word "No" added in pencil to the insertion in ink.

⁵ This sentence is scored in the margins.

⁶ Thomas Andrew Knight. "An account of some experiments on the fecundation of vegetables",
Phil. Trans. Roy. Soc. 1799, p. 195. cf. Charles Darwin. *Variations in animals and plants* . . . ,
London 1868, vol. 2, p. 175 : "it is a law of nature that organic beings shall not fertilise themselves for
perpetuity. This law was first plainly hinted at in 1799, with respect to plants, by Andrew Knight."
This principle is sometimes referred to as the Knight-Darwin law.

⁷ These five words crossed out.

⁸ From here the text is written in ink.

⁹ Leopold von Buch. *Reise durch Norwegen und Lappland*, Berlin 1810. These 13 words enclosed
between square brackets.

¹⁰ Thomas Andrew Knight. "On the want of permanence of character in varieties of fruit when pro-
pagated by grafts and buds," *Trans. Hort. Soc.*, vol. 2, 1822, p. 160.

fruit-trees grafted altering is hostile to this: but on other hand, fruit trees are propagated by means, which wild plants never are, namely on stocks of other varieties & we know that the kind of stock greatly affects the graft. — Plants circumstanced as the gorze must be propagated by its roots: now it is curious Mr K[night]¹ has observed that to graft from the roots is the best way to get young trees from worn-out | kinds, & quotes from Pliny that it is bad to graft from top shoots. — If pro-
 154 longation of life by gemmation being impossible can be overturned, then the conclusion that the two kinds of generation have some most important difference is forced on us. — My theory only requires that organic beings propagated by gemmation do not now undergo metamorphosis, but to arrive at their present structure they
 155 must have been propagated by | sexual commerce. The fact of corallaria & Halimeda is case in point. — The relation of these sexual functions to complexity is evident, yet the inference from *some* plants & *some* mollusca being hermaphrodite is, that intercourse every time is of no consequence in that degree of development — It is singular there is no true hermaphrodite in beings which have² fluid sperma. —)

I³ utterly deny the right to argue against my theory because it makes the world
 156 far *older* than what geologists think: it would be doing what | others but fifty years since [did] to geologists, — & what is older — what relation in duration of planet to our lives — Being myself a geologist, I have thus argued to myself, till I can honestly reject such false reasoning |

157 Bell⁴ Bridgewater Treatise on the Hand. — p. 94. “The resemblance of the foot of the Ostrich to that of the camel has not escaped naturalists”. Before he alludes to the resemblance of the snout of the mole & Pig in having two additional bones to give strength to it. — p. 139. Doubts altogether the law of balancing of organs.⁵ — In the Batrac[h]ian Order the 32 ribs are wanting. p. 144 in the Ichthyosaurus 60 or 70 bones in the paddle, yet all in the arm are perfect. — p. 144. Alludes to two theories; — the species are the result of circumstances;⁶ — or the will of the
 158 animal. | p. 145. Seems to argue, that as the transformation from the egg, a larva, or foetus to perfect animal are adapted by foreknowledge,⁷ so must the mutations of species !! — p. 203 Chaetodon squirting water at fly,⁸ — instinct, for how could

¹ Thomas Andrew Knight. “Upon the advantage of propagating from the roots of old ungrafted fruit trees”, *Trans. Hort. Soc.*, vol. 2, 1822, p. 252.

² The words “which have” substituted in pencil for “with”. This sentence enclosed between square brackets.

³ From here to the end of page 156 the Text is written in pencil.

⁴ Sir Charles Bell. *The Bridgewater Treatises. The Hand, its mechanism and vital endowments as evincing design*, London 1833, p. 94.

⁵ Sir Charles Bell. *Ibid.* p. 139: “Shall we follow a system which informs us that when a bone is wanting in the cavity of the ear we are to seek for it in the jaw?” With a rare degree of irony, this is exactly what Reichert’s established theory of homologies of the mammalian ear-ossicles requires in demonstrating that the malleus and incus of the mammal are the articular and quadrate of the reptile.

⁶ Sir Charles Bell. *Ibid.* p. 144: “It is, above all, surprising with what perverse ingenuity men seek to obscure the conception of a Divine Author, an intelligent, designing and benevolent Being—rather clinging to the greatest absurdities, or interposing the cold and inanimate influence of the mere “elements”, in a manner to extinguish all feelings of dependence in our minds, and all feelings of gratitude.”

⁷ Sir Charles Bell. *Ibid.* p. 145: “We do perceive surprising changes in the conformity of animals. Some of them are very familiar to us; but all show a foreknowledge and a prospective plan.”

⁸ Sir Charles Bell. *Ibid.* p. 202: “We have a more curious instance of the precision of the eye and of the adaptation of muscular action in the *Chaetodon rostratus*. This fish inhabits the Indian rivers and lives on the smaller aquatic flies. When it observes one alighted on a twig or flying near (for it can shoot them on the wing) it darts a drop of water with so steady an aim as to bring the fly down into the water, when it falls an easy prey.”

experience teach distances in air, in which it never touches objects. — far better case than chicken pecking fly. — “whilst the shell sticks to its tail” as mentioned by Sir J. Banks¹ p. 212. — p. 282. Allows this instinctive power in chicken, yet says it is evidently acquired by experience in baby² |

- 159 Lamarck³ vol. II, p. 152 *Philosophie Zoologie*. says it is not sufficiently proved that any shell fish is really hermaphrodite, & even oyster may fecundate each other, by the means of the medium in which they live.

ditto⁴ “Additions” p. 454. — does really attribute metamorphoses to *habits* of animals & takes series of flying mammals — says lemur volans has skin between its legs. — strangely consider existing long-organized forms as parent forms of existing highly organised forms — this resulted from the necessity of supposing some inward progressive developing power. — |

- 160 My theory leaves quite untouched the question of spontaneous generation. —

Introduction to Bartrams⁵ *Travels* p. XXIII. Both sexes of some birds sing equally well, and then reciprocally assist in domestic cares, as building nest, sitting on eggs & feeding & defending their young. — The oriolus (icterus cat.) is an instance of this, & the female of the icterus minor is a bird of more splendid plumage than the male. — |

- 161 Athenaeum⁶ May 18 1839, p. 377. — Statement that the climate is on the decline, as far as vegetation is concerned, in parts of the Northern French expedition, — rather the reverse of facts stated by Smith⁷ of Jordan Hill. — |

- 162 May 27th Henslow.⁸ One of the 4 species of Lemma only reproduces itself in hybrid, as yet observed by buds — (the other three by buds & seeds though by the latter very rarely) here is a case in answer to Mr Knights⁹ doctrine. — Case like Corallina —

¹ Sir Charles Bell. *Ibid.* p. 212 : “The late Sir Joseph Banks, in his evening conversations, told us he had seen, what many perhaps have seen, a chicken catch a fly whilst the shell stuck to its tail.”

² Sir Charles Bell. *Ibid.* p. 282 : “This faculty of reaching for the object is slowly acquired in the child ; and, in truth, the motions of the eye are made perfect, like those of the hand, by slow degrees. . . . It is no contradiction to this, that the faculty of vision is made perfect in the young of some animals from the beginning ; no more than that the instinct of the duck, when it runs to the water the moment that the shell is broken, should contradict the fact that the child learns to stand and walk after a thousand repeated efforts.”

³ Jean-Baptiste de Lamarck. *Philosophie Zoologique*, Paris 1809, tome 2, p. 152 : “on sait que quantité de mollusques, réellement hermaphrodites, se fécondent néanmoins les uns les autres. A la vérité, parmi les mollusques hermaphrodites, ceux qui ont une coquille bivalve, et qui sont fixés comme les huîtres, semblent devoir se féconder eux mêmes.” (1873 reprint tome 2, p. 139.)

⁴ Jean-Baptiste de Lamarck. *Ibid.* tome 2, p. 454 : “les écureuils volans . . . dans l'habitude d'étendre leurs membres en sautant, pour se former de leur corps une espèce de parachute . . . par des répétitions fréquentes de pareils sauts dans les individus de ces races, la peau de leurs flancs s'est dilatée de chaque côté en une membrane lâche qui réunit les pattes postérieures à celle de devant.” (1873 reprint tome 2, p. 416.)

⁵ William Bartram. *Travels through North and South Carolina, Georgia, East and West Florida*, Philadelphia, 1791. The passage referred to is on p. xxxii of the Introduction.

⁶ *Athenaeum*, 18th May 1839, p. 377 : “French scientific expedition in Northern Europe.” “We learned one thing, however, which is not without interest, concerning the climate. It has long been believed that vegetation, in the more northern parts of Lapmark, is constantly on the decline ; and large tracts of land are found under the lee of the mountain, formerly covered with fir woods, where now only stumps and rotten roots of fir trees, with a few miserable birch, are to be seen.”

⁷ James Smith. “On the climate of the newer pliocene tertiary period.” *Proc. Geol. Soc. Lond.*, vol. 3, 1839, p. 118 : “Mr. Smith observed, that many of the most common shells in the raised beds of the basin of the Clyde are identical with species found by Mr. Lyell at Uddevalla in Sweden ; and he has been induced to conclude from the arctic character of the testacea, that the climate of Scotland during the accumulation of these beds was colder than it is at present.”

⁸ John Stevens Henslow.

⁹ Thomas Andrew Knight. “An Account of some experiments on the fecundation of vegetables.” *Phil. Trans. Roy. Soc.*, vol. 89, 1799, p. 195. See above footnote to MS. page 152.

Does it flower anywhere? Yes on the Continent ¹— is there more variation in its character? — No — well characterized. —

Tulips are cultivated during several years & then they break. — each tulip is the product of fresh bud — here then is case of change analogous to change in grafted trees : so is not effect of different stocks in this case — & strong case showing analogy of production by gemmation & by seed — which Henslow is inclined to think very close. — A fruit tree by certain treatment will suddenly send forth quantities of blossoms. — |

163 The case of the Lemna, and the viviparous grasses, which no doubt are propagated during hundreds of years, without fresh seeds arising, — throws a very great difficulty on my theory, here we have a plant remaining constant, without crossing, — & propagation by buds does not injure constancy of form. — is the constancy owing to similarity of conditions — & that no change would affect them in short period & hence no change would affect them, without affecting all the individuals — hence there would be real gradation in species from one region to another. — These simple forms perhaps oldest in world & hence most persistent — if forms exceedingly difficult
164 to vary, the run of chances, would prevent it varying | A plant propagating itself by buds is in same predicament, as one, in which structure does not allow of crossing with other individuals with facility — such as cryptogamic plants & true hermaphrodite mollusca, & probably corals. — these forms then ought to be very persistent, & their necessity of crossing is much less, — now certainly in the higher animals, changes seem to have been more rapid, & the facility for intermarriage is greater (Hence Dioecious plants highest — Palms &c &c) — Is there greater resemblance between carboniferous & recent mollusca, than between the corresponding aculeata? — But if Aculeata do not cross there would by my theory [be] gradation of form from one species to other : therefore my theory does require crossing. — The case of Lemna shows dispersion of germs is not end of seminal reproduction. — Likewise grasses having seeds, — as Cocos de mer — analogy shows some most important end. — |

165-176 excised.

177 Cocos Isl^d & Preparis between Andaman & Pegu abound with monkeys & squirrels. — Horsborough² E. J., Directory vol. II, p. 46.

Carimon Java (between Borneo & Java) Lat 5° 50' S adjoining it are several small islands abounding with deer, — Horsborough,³ vol. II p. 527. —

Journal of Asiatic Society⁴ vol. I, p. 261 Catalogue of Birds of India

ditto p. 555 Lieut. Hutton⁵ counted the ova of a tick in India & found there were

¹ These four words inserted between lines.

² James Horsburgh. *India Directory, or Directions for sailing to and from the East Indies, China, Australia, Cape of Good Hope, Brazil, and the interjacent Ports* : London 1936, p. 46 : " Little Coco. . . . These islands, and Preparis, abound with monkeys and squirrels ; larger animals have not been seen upon them."

³ James Horsburgh. *Ibid.* p. 527 : " Carimon Java, . . . Adjoining to it, are several small islands and rocks, some of which abound with deer, . . . "

⁴ *Journ. Asiatic Soc. Bengal*, vol. 1, 1832, p. 261. " Catalogue of Indian Birds ", comprising the collections of Major James Franklin and Mr. John Gould.

⁵ Thomas Hutton. " Notes in Natural History ", *Journ. Asiatic Soc. Bengal*, vol. 1, 1832, p. 554 : On p. 555 : " I found that I had waded through the almost incredible number of 5,283 ova."

178 5,283 attached to its body | Journal of the Asiatic Soc. Vol. I, p. 335 Catalogue of animals of Nepal by B. Hodgson¹ p. 336 In the *most pestiferous* region (mentioned by Heber)² from which *all* mankind (& yet afterwards says native tribes can live there) flee during 8 months out of 12, — the largest mammals in the world constantly reside & are bred³. "take tame animals into this region between April & October & like man *almost* (this looks inaccurate C.D.) they will catch the Malaria & die. — On the other hand there are breeds of men the Thâsû & the Dhangar who can live there & do not pine visibly. p. 337 it would appear as if⁴ |

179-182 excised.

183 The possibility of different varieties being raised by seed is highly odd — as it is not so with the esculent vegetables — how is it with hollyoaks, flaxes, &c &c ?⁵ Mr. Herbert⁶ in letter says distinctly, that Hollyoak reproduce each other & yet I presume seed raised in same garden. — Now this good question, single or half double — anyhow fertile because they are raised by seed. — Where has Duchesne⁷ described Atavism. — ask Dr Holland⁸ case where peculiarity has first appeared. — *Storia della Riproduzione Vegetale* by Gallezio,⁹ Pisa 1816 p. 27 Dr Holland.¹⁰ |

184 Are there instances of plants, in becoming double losing [losing] fertility of, sometimes one sex & sometimes other, so as to become monoecious. — Are there not wild plants, some partly Dioecious ?

Mushroom Hybrids ?

Any wild plants in England which do not perfect their seed ? — What animals can be budded & rendered of great age as must be inferred from what Mr Knight¹¹ says. Hort. Transact. V. II, p. 252.

¹ Bryan Houghton Hodgson. "On the Mammalia of Nepal" *ibid.* vol. 1, 1832, p. 335.

² Reginald Heber. *Journey through the Upper Province of India, from Calcutta to Bombay, 1824-5, (with notes on Ceylon); to Madras, & South Provinces, 1826; & Letters written from India*, London, 1828.

³ Bryan Houghton Hodgson. *op. cit.* p. 336: " . . . it is worthy of remark, that in this pest-house, from which all mankind flee, during 8 months of every 12, constantly reside and are bred some of the mightiest quadrupeds in the world. The royal tiger, the panther, the leopard, the elephant, the *arna* or wild buffalo, the rhinoceros, and stags of the noblest growth, abound: and, what to our fancies is less singular, the same malarious region cherishes Boa constrictors of the largest size, and other huge creatures of their kind."

⁴ Bryan Houghton Hodgson. *Ibid.* p. 337: (the sentence continues) "the principal thought is that of inherited habits of body, or acclimatization, carried to such perfection by course of time, in respect to the great quadrupeds, as to have superseded their original and natural habits of body."

⁵ From the top of the page to here the text is in pencil. This page and page 184 are written across the narrow width of the paper and have been lightly scored through.

⁶ William Herbert. See footnote to MS. p. 144 *supra*.

⁷ Henri-Gabriel Duchesne. Author of *Manuel du Naturaliste*, Paris 1797, in which, however, there is no entry under Atavisme.

⁸ Henry Holland (1788-1873).

⁹ Giorgio Gallezio. *Storia della Riproduzione Vegetale*, Pisa 1816, p. 27.

¹⁰ Henry Holland. *Medical Notes and Reflections*, London 1839.

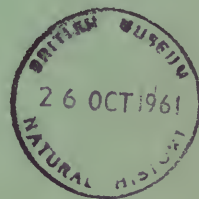
¹¹ Thomas Andrew Knight, "Upon the advantage of propagating from the roots of old ungrafted fruit trees", (read 3rd December, 1816), *Trans. Hort. Soc.*, vol. 2, 1822, p. 252: "the general law of nature appears to be that no living organized being shall exist beyond a limited term of years; and that law must be obeyed. It is nevertheless in the power of man to extend the lives of individual vegetable beings far beyond the period apparently assigned by nature; and parts of the same annual plant may be preserved through many years, perhaps through ages, though it cannot be rendered immortal." Darwin's question was answered about eighty years later by C. M. Child's experiments on rejuvenation of planarians and A. Carrell's tissue-cultures of chick heart muscle for periods far exceeding the normal life-span of poultry.

B. M.
A.
O.

DARWIN'S NOTEBOOKS ON TRANSMUTATION OF SPECIES

ADDENDA AND CORRIGENDA

Edited with Notes by
SIR GAVIN DE BEER and M. J. ROWLANDS



BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
HISTORICAL SERIES

Vol. 2 No. 6

LONDON : 1961

DARWIN'S NOTEBOOKS ON TRANSMUTATION OF SPECIES

ADDENDA AND CORRIGENDA

Edited with Notes

BY

SIR GAVIN DE BEER and M. J. ROWLANDS

Pp. 185-200



BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
HISTORICAL SERIES

Vol. 2 No. 6

LONDON: 1961

THE BULLETIN OF THE BRITISH MUSEUM
(NATURAL HISTORY), instituted in 1949, is
issued in five series corresponding to the Departments
of the Museum, and an Historical Series.

*Parts will appear at irregular intervals as they become
ready. Volumes will contain about three or four
hundred pages, and will not necessarily be completed
within one calendar year.*

This paper is Vol. 2, No. 6 of the Historical series.

© Trustees of the British Museum, 1961

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued October 1961

Price Seven Shillings

DARWIN'S NOTEBOOKS ON TRANSMUTATION OF SPECIES

ADDENDA AND CORRIGENDA

Edited with Notes by

SIR GAVIN DE BEER & M. J. ROWLANDS

ADDENDA

OF the pages excised by Darwin from his Notebooks on Transmutation of Species, 28 have been recovered. In the British Museum (Natural History) 10 pages were found among the Darwin papers and letters deposited by Mr. Robin Darwin; these are indicated by an asterisk* following the Roman number in the margin indicating the number of the Notebook concerned. The remaining 18 were found among the Darwin MSS. in the Cambridge University Library by Miss M. Skramovsky with the kind assistance of Mr. P. Gautrey; these are indicated by a dagger†. The particular Notebook from which the pages were excised was determined by comparison of the scissor-cuts with those of the stumps in the Notebooks.

The reasons which led Darwin to adopt the method of cutting pages out of his Notebooks are obscure. His entries of "All useful pages cut out", made in December 1856, show that he wanted to use them for his large work on Species on which he was then engaged. Two of the pages printed below were found attached to the manuscript of his larger work. Attention to this fact was first kindly drawn by Professor Robert C. Stauffer of the University of Wisconsin. What the fate of the many other comparable pages can have been, it is, unfortunately, not hard to conjecture. It may not be legitimate to draw conclusions from the relatively small number of excised pages that have been found, but it is difficult to avoid asking the question why these particular pages should have been considered by Darwin to be more "useful" than many of those which he did not excise.

One of the pages, (105 from Notebook II) contains material about the similarity of nest-building instincts in different species of thrushes in the Old and New Worlds, which can be traced right through to the *Origin of Species* (World Classics edition, 1956, page 304). Another page (160 from Notebook II) on woodcocks in Madeira having lost their migratory instinct, appears in the *Essay of 1844* (Cambridge University Press edition, 1958, p. 142).

These pages are printed below in order to make the transcription of Darwin's Notebooks on Transmutation of Species as complete as the available material allows. We should like to express our thanks to Miss M. Skramovsky for her invaluable help in this work.

The page references are to the *Manuscript* pages of the Notebooks.

FIRST NOTEBOOK

I*

- 151 Marcel Serres¹ p. 331. l'Institut considers that² Geo. Journ.³ p. 325. Vol. IV. Ducks on rivers in Guiana. build top of trees carry duckling to the water in their beak, & the young one directly *by instinct* can dive & conceal themselves in the grass. —

Beatson⁴ St. Helena says no trees succeed so well at St Helena as Pineaster & Mimosa called Botany Bay Willow

V. Dr Royle⁵ introductory remarks to Himalaya Mountains — |

- 152 Bory St Vincent⁶ Vol. III, p. 164. "L'île de la Reunion presente elle seule plus d'especes polymorphes que toute la terre ferme de l'ancien monde". —

Considers forms in recent volcanic islets not well fixed. —

Peron⁷ thinks Van Diemen's land long separated from Hobart Town — (from difference of races of men and animals) |

I*

- 165 Mr. Martens⁸ of Zoolog Soc told me an Australian dog he had, used to burrow like fox. — a sort of internal bark. would remain for long time together in tub of water with only nose projecting. — would pull the garden bell, then run into the kennel to watch who would come to the door — would constantly do this, so was obliged to be removed. — In l'Institut⁹ 1837. p. 404 account of instinct of dogs. — agreement & reason |

- 166 Some animals common to Mauritius & Madagascar.

Proceedings of Zoolog. Soc.¹⁰ June 1837 p. 53. an Irish rat different from English. — Waterhouse¹¹ has information respecting the Water Rat. — |

¹ Marcel de Serres. *L'Institut*, tome 5, Paris 1837, p. 331, "De la présence du fer sulfuré sublimé dans les calcaires tertiaires des environs de Montpellier".

² This line is crossed out in the MS.

³ William Hilhouse. *Geogr. J.*, vol. 4, London 1834, p. 325. "Here I have seen, at the top of a decayed eta* [tree] the nest of the tropical musk duck, which we improperly call Muscovy, with the parents bringing singly, from a height of seventy or eighty feet, their newly hatched progeny to their natural element beneath: they appear to lay hold of the duckling with the bill by the neck, . . . the young though for the first time, diving fifty feet at a stretch, and hiding in the grass so as to defy pursuit — such is instinct."

⁴ Alexander Beatson. *Papers relating to the Devastation committed by Goats on the Island of St. Helena*, St. Helena 1810.

⁵ J. Forbes Royle. *Illustrations of the Botany and other Branches of the Natural History of the Himalayan Mountains, and of the Flora of Cashmere*, London, [1833] 1839 [1840].

⁶ J. B. G. Bory St. Vincent. *Voyage dans les quatre principales îles des Mers d'Afrique*, . . . Paris 1804, tome 3, p. 164; "L'île de la Réunion présente elle seule plus d'espèces polymorphes que toute la terre ferme de l'ancien monde."

⁷ François Péron. *Voyage de découvertes aux Terres Australes* . . . Paris 1816, tome 2, p. 1.

⁸ William Charles Linnaeus Martin (1798–1864), superintendent of the Zoological Society's Museum from 1830 to 1838.

⁹ Anonymous. *L'Institut*, tome 5, Paris 1837, p. 404; "Chronique". "Un chien, auquel on voulait apprendre à monter une échelle, fatigué ou ennuyé de cet exercice, s'en alla: mais le lendemain, on le vit retourner seul à l'échelle, et s'appliquer à réussir, comme si un mouvement d'amour-propre le poussait à tenter ce nouvel essai."

¹⁰ William Thompson. *Proc. Zool. Soc. Lond.*, vol. 2, 1837 [June 13]. "Mammalia", p. 52. On p. 53; "*Mus Hibernicus*. Irish Rat. A black rat which has been seen in the north of Ireland, . . . that it had a white breast . . . This individual differs from the *M. Rattus* as described by other authors, and also from specimens preserved in the British Museum, and in the collection of the Society: in the relative proportion of the tail to that of the head and the body: in having shorter ears, and in being better clothed with hair . . ."

¹¹ George Robert Waterhouse. *Proc. Zool. Soc. Lond.*, vol. 2, 1837 (February 14). p. 15; describes "numerous species of the genus *Mus*, forming part of the collection presented to the Society by Charles Darwin, Esq." [*Mus tumidus*].

I†

- 187 Mr. Don¹ gave me instances of one species of Australian genus being found in Sumatra ; again another of other genus in Sandwich islands — A genus with species in Van Diemen's land and Tierra del Fuego. — Araucaria species. Brazil, Chile, Norfolk Isl. — Isle of Pines. — Australia. — A South American form of *Lathyrus* has one species in Europe ; Madagascar has several American forms — The above
- 188 facts evidently show that Mr. D[on] wonders | at these species being wanderers. —

Iceland no species to itself, a remark common to all northern isl^{ds}. — This is interesting, because Iceland must have been all ice in time of ice transported. — This gives room to fine speculation. — Are there many *Northern genera* peculiar to itself. — |

I*

- 197 & Europe as to produce same one. —

Although in plants you cannot say that instincts perverted yet organization especially connected with generation certainly is. —

The dislike of two species to each other is evidently an instinct ; & this prevents breeding. now domestication depends on perversion of instincts (in plants domestication or perversion of structure especially reproductive organs) & therefore the one distinction of species would fail. But this applies only to coition & not production. But who can say whether offspring does not depend on mind or instinct of parent

- 198 Mem. Lord Moreton's² Mare. — the fact of plants going back | hybrid plants ; analogous to Men & dogs. Now if we take structure as criterion of species Hogs different species, dogs not, but if we take character of offspring, Hogs not different. some dogs different. —

Henslow³ says (Feb 1838) that few months since in *Annales des Sciences*⁴ paper on Botany of Tahiti.

In Charlesworth Magazine⁵ Jan 1830 most curious paper on hereditary fear (like rooks with gun) of two |

SECOND NOTEBOOK

II*

- 195 How remarkable that *Turdus Magellanicus* in the S. Hemisphere (replaced to the North by other species) should build a nest lined with mud, in forest where not a tree in which it build, a berry on which it feeds or insects it devours is same species, yet that it should so strictly agree in habits with the *Turdus Musicus* not found in N. America whose southern range is ?

¹ David Don. "On the Coniferae at present growing in Australia". *Edinburgh New Philosophical Journal*, vol. 14, 1833, pp. 158-159.

² George, Earl of Morton. *Phil. Trans. Roy. Soc.*, vol. 111, London 1821, p. 20. "A singular fact of natural history. Peculiarities of the progeny of an Arab horse from a mare that had previously bred with a Quagga".

³ John Stevens Henslow. Personal communication.

⁴ Jean-Baptiste-Antoine Guillemin. *Annales des Sciences Naturelles*, tome 7, Paris 1837, pp. 177, 241, 349. "Zephyritis Taitensis.—Énumération des plantes découvertes par les voyageurs dans les Iles de la Société, principalement dans celle de Taïti".

⁵ Philocheidon. *Mag. Nat. Hist.*, vol. 3, London 1830, p. 35. On p. 37;—"It has been somewhere observed, I think, by White, that 'they are hardly to be scared by a gun', . . . "

The black & white thrush of Azara¹ builds its nest in something same manner, much mud. — These facts show, habits hereditary whilst species have changed. |

- 106 *Argumentum ad absurdum*. The creative American halo has extended to Juan Fernandez in birds but ? whether to same island in plants ? — What is this halo. — continents are not stationary, unerring proofs not always continents. — it is a plastic virtue. — it is expression for ignorance

Two grand classes of varieties ; one where offspring picked, one where not. — the latter made by man & nature, but cannot be counteracted by man. — effect of external contingencies & long bred in — Mem. a statement in Mr. Wynne's book², about not altering breed of animals in certain countries. — |

II†

- 159 Major Mitchell³ does not know whether the breeds of oxen have deteriorated or altered, but it is certain that rams & bulls from England fetch very large price as is evident to be worth introducing, instead of breeding from original Durham breed. — Native dogs & English cross readily. — thinks about half way in appearance. — bark about half way in tone — the native dogs howl most dismally, very rarely bark — are almost useless not the least notion of hunting, or keeping watch. how completely nature & instincts modified —

The partial migration of birds in same country may explain greater migrations. if America intersected wider & wider if Rio Plata birds which have originally crossed would continue to cross, means of knowing direction, mysterious

- 160 Were the woodcocks which came Madeira & ceased their migrations lost ?? I conceive a bird migrating from Falkland Is⁴ regularly to main land proof of land having been formerly nearer. —

Selby⁴, Magazine of Zoology & Botany No. XI p. 390 a slight change in enclosing a common seems in part of [*blank*] to have almost banished the Grasshopper Warbler. — yellow wagtail never seen in one district. though common on another. (golden crested wren so rare in some counties. nightingale ditto — all show how nicely adapted species to localities.

p. 390⁵ young ring ouzel dive instant touch the water. — capital instance of typical land bird, having habits of a grebe, structure might follow.⁶ — |

¹ Felix de Azara. *Voyages dans l'Amérique Méridionale*, Paris 1809 tome 3, p. 210. "La Grive blanche et noirâtre". On p. 211 ;—"Les habitudes naturelles de cette grive sont les mêmes que dans l'espèce précédente : mais elle est une peu plus rare."

² Wynne, possibly M. B. Wynn author of the Preface to *The Breeder's and Fancier's Pedigree Book : A book of forms with a preface by M. B. Wynn*, London [1879]. He was at one time the Secretary of the Mastiff Club. cf. I 139, 141, II 120.

³ Thomas Livingstone Mitchell. *Three expeditions into the Interior of Eastern Australia*, etc. London 1838.

⁴ Prideaux John Selby. *Mag. Zool. Bot.*, vol. 2, London 1837-38, p. 387. "The Fauna of Twizell". On p. 390 ;—"... the grasshopper warbler (...) which, during the early growth of many of the plantations ... might be heard in various directions, pouring forth its sibilous note, ... is rarely heard, and then only in the brushwood adjoining the moor and other open ground ..."

⁵ Prideaux John Selby. *ibid.* p. 390 ;—"... The young ... dive instinctively the moment they touch the water ..."

⁶ In the middle of the page, in pencil, are the figures 7 and 23.

II†
253*Acclimitisation*¹

Bachman² tells me in Audubon³ there is most curious history of first appearance of the S. American Pipra Flycatcher which is now becoming common — likewise of the *Hirundo fulva*⁴ (added by Audubon in appendix) showing what changes are taking place & how birds are extending their ranges — even migratory birds like swallows.

Of migrations of birds he mentioned many most curious cases. The birds seem to follow narrow bands, certain kinds as gallinules taking the low country near coast & other the mountains, & then⁵ | appearing to remain about a fortnight. See Silliman's Journal 1837. Paper by Bachman.⁶ that is succession of birds. — in some species as *Tanagra* males come first & then females in flocks as in English nightingales — other birds (& this seems common kind migration of America) migrate singly flying few miles every day & generally by night — other birds which is strictly diurnal, migrates singly by night. — others in flocks. These birds seem clearly directed by kind of country; kind of migration quite different in species of same genus. The *Muscicapa solitaria* stay about a fortnight in one particular part of country, like White⁷ of Selborne Rock Ouzels. If the line of bands or country (These facts show the normal condition of migration)⁸ |

THIRD NOTEBOOK

III†

47 half breed liable to vary. I asked this in many ways, but received same answer. — Thought lambs were more like father than mother. — The cross not so hardy as Black faced, but more tendency to fatten — This man confirmed my account of the Shepherd dogs. —

Aug. 24th Was struck with pink shade on plumage of the Pelican. — Mem. pink spots on Albatross, on some Gulls Flamingo — (Spoonbill waders Ibis) a law of plumage might possibly be made out. — |

48 August 25th *Athenaeum*⁹ (1838) p. 611 L^d Tankerville¹⁰ account of wild cattll of Chillingham, — habits peculiar, — *young* one 2-3 days old butted violently & fell. —

¹ This heading is inserted in pencil.

² Rev. John Bachman. Personal communication.

³ John James Laforest Audubon. *Ornithological Biography*, etc. Edinburgh 1839, vol. 5, p. 420. "Tyrant Flycatcher". On p. 421;—"... Pipirit [Pipirie] Flycatcher ... How wonderful it is that this bird should be found breeding over so vast an extent of country, and yet retire southwards of the Texas, to spend a very short part of the winter! ..."

⁴ John James Laforest Audubon. *ibid.* Appendix, p. 415.

⁵ In pencil the figure 9 is written in the middle of the page.

⁶ Rev. John Bachman. *Silliman's Journal*, vol. 30, 1836, p. 81. "On the Migration of the Birds of North America".

⁷ Gilbert White. *The Natural History of Selborne*, etc., London 1822, vol. 1, p. 114, Letter XXIV (to Thomas Pennant). On p. 115;—"It is remarkable that they make but a few days stay in their Spring visit, but rest near a fortnight at Michaelmas, ... [ring ouzel]."

⁸ In pencil the figure 23 is written in the middle of the page.

⁹ J. Hindmarsh. *Athenaeum*, 1838, p. 611. "On the wild Cattle of Chillingham Park". This includes letters from Lord Tankerville and Mr. Cole, a keeper, and was followed by a discussion in which Mr. Webb Hall also took part.

¹⁰ Charles August Bennet, 5th Earl of Tankerville 1776-1859.

gore to death the old & wounded¹ — are bad breeders & subject to the rush as all animals which breed in & in are — see Annals² vol. 2 1839. — colour white uniform crafty, go in file, hide their young, bold —

a Mr. W. Hall³ remarked that it was against all rules their preserving character & breeding in & in⁴ — nonsense a flock of more than 100 — Agrees nearly with account given by Boethius⁵ of ancient caledonian Cattle. Instinct⁶ |

III†

- 85 here freely. — Here we have beautiful proof of the breeding in & in (like EFFEMINATE men courage in dogs⁷), — if carried much further, if by the process this were possible, the organs doubtless would shrivel up. — This character of not having sexual plumage⁸ is very common by hybrids, that are infertile. — thus the common pheasant & fowl when crossed never even lay eggs. & the men cannot hardly tell any sex by appearance. — The silver & common pheasant⁹ crossed, has a cock (infertile) the breast of¹⁰ |
- 86 which is like common pheasant & back like silver. — But the hen hybrid of this bird, has long tail figure, & some degree of whiteness like a male. — Thus castration, hybridity & breeding in & in tend to produce same effects. — ¹¹May it be said that breeding in & in tends to produce unhealthiness — or to perpetuate some organic differences. — it may be so, but this assumption as long as animals are healthy |

III†

95. Sept. 11. Mr. Blyth¹², at Zoolog. Meeting stated, that Green finch, all linnets, red pole, gold finch, hawfinch, in nursling plumage resembled that of Cross Beak. — In lark if I understand right, all species have same character which is mottle & not like¹³ any existing species. — In two herons¹⁴ *plumage* of both (nursling) quite similar. — One

¹ These seven words subsequently underlined in soft pencil, and "Ch. 3" added between lines, referring to the 3rd chapter of Darwin's unfinished work on Natural Selection. This chapter was entitled "On the Possibility of all Organic Beings Occasionally Crossing and on the Remarkable Susceptibility of the Reproductive System to External Agencies" (*Handlist of Darwin Papers at the University Library Cambridge*, 1960). The parallel between the behaviour of the Chillingham cattle and William Cowper's hares is drawn in Darwin's Fourth Notebook MS. p. 117.

² J. Hindmarsh. *Ann. Nat. Hist.*, vol. 2, London 1838–1839, p. 156.

³ Webb Hall.

⁴ This sentence slightly scored out.

⁵ Hector Boece (Boethius). G. Kenneth Whitehead, *The Ancient White Cattle of Britain and their Descendants*, London [1953], On p. 24;—"These animals, states Hector Boece (Variously spelt Boethius) in his *Scotorum Historiae* (circa 1527), 'thought they semit meik and tame in the remnant figure of their bodyis, thay wer mair wild than ony uthir beistis, and had sic hatrent [hatred] aganis the societi and cumpany of men, that thay come nevir in the woddis na lesuris quhair thay fand ony feit or haund thairof: and; mony dayis after thay eit nocht of the herbis that wer twichit or handillitt be men.'"

⁶ This word added subsequently in pencil.

⁷ The words "courage in dogs" added subsequently.

⁸ The words "sexual plumage" subsequently underlined.

⁹ The words "silver and common pheasant" subsequently underlined.

¹⁰ Across the page, in pencil, were subsequently added the following;—"Yet odd they sh^d have so much sexual character as they have". The figure 17 is added in pencil.

¹¹ A square bracket is opened here.

¹² Edward Blyth. *Proc. Zool. Soc. Lond.*, vol. 2, 1838 [September 11] p. 115;—"Mr. Blyth made some remarks on the plumage and progressive changes of the crossbill ..."

¹³ The figure 12 is inserted here in pencil.

¹⁴ William Yarrell. *Proc. Zool. Soc. Lond.*, vol. 2, 1831 [January 25] p. 27;—"... In a young bird which united in its plumage the brown spotted wing of the *Gardenian Heron* with the black head and ash-coloured back of the *Night Heron*; thus exhibiting the change from the young to the adult bird, and proving that the two supposed species are really but one ..."

species retained this character in adult stage, other alters entirely. In common sparrow young & female similar plumage in tree sparrow (if I understood rightly) 96 young cock & | hen all nearly similar. — in Blackbird group young like some of the species — (? do these facts indicate that the change is effected through the male ??) — Yarrell¹ observed that female of some water birds (as Phalarope) assume for breeding a more brilliant plumage than the male. — My case of Caracara N. Zelandiae.² —

Mr. Blyth³ stated that there are two ducks which have pretty close representative species in England & N. America. — the teal which some authors⁴ |

III†

103 *Cervus campestris* spotted white when a fawn compare with *fallow* ? deer & Morschus &c. &c. — like young blackbirds

Dr Bachman⁵ told me that $\frac{1}{2}$ Muscovy & common duck were often caught wild off coast of America — showing that hybrids can fare for themselves.

first year the bird fanciers match their birds to see which will sing *longest* & they in evident rivalry sing against each other, till it has been known one has killed itself.⁶

Sir J. Sebright⁷ has almost lost his Owl-Pidgeons from infertility, — Yarrell⁸ says in such case they exchange birds with some other fancier. thus *getting fresh blood* without *fresh feather* & consequent trouble in obliterating the fresh feather by crossing.⁹ — |

104 It seems from Lib. of Useful Knowledge that sheep originally black & Yarrell¹⁰ thinks the occasional production of black lambs is owing to old return. — The Rev. R. Jones¹¹ told me precisely the same story about southern, see p. 43 supra, breed of cattle with white heads, which years afterwards occasionally went back — (Effect of imagination on mother. white peeled rods mentioned in old Testament placed before sheep¹² — it has been thought that silver pheasants about a house made other pheasants have white feathers.) —

It certainly appears in domesticated animals that the amount of variation is soon reached — as in pigeons no new races. — |

¹ William Yarrell. *A History of British Birds*, London 1845, vol. 3, p. 130. "The Grey Phalarope". On p. 133 ;—" . . . The females of this species appear to assume more perfect colours, in the breeding season, and to retain them longer than the males . . . "

² Charles Darwin. *Journal of Researches*, etc. London 1839, p. 66 ;—*Polyborus Novae Zelandiae*.

³ Edward Blyth. Presumably unrecorded remark at a meeting of the Zoological Society.

⁴ The lower half of this page lightly scored through.

⁵ Rev. John Bachman. Personal communication.

⁶ Edward Stanley. *A Familiar History of Birds*, London 1814, vol. 1, p. 72 ;—" Goldfinches . . . are put in small cages, with wooden backs, and placed near to, but so that they cannot see, each other ; they will then raise their shrill voices, and continue their vocal contest till one frequently drops off its perch, perfectly exhausted . . . "

⁷ Sir John Sebright.

⁸ William Yarrell. Personal communication.

⁹ A line is drawn across the page with the figure 2 in a circle, to the right of which is the figure 12 in pencil.

¹⁰ William Yarrell. Personal communication.

¹¹ cf. Third Notebook MS. page 43.

¹² cf. Introduction to First Notebook, page 28.

III†

113 Sept. 17th. Saw mule apparently fathered by a donkey with all four legs ringed with lines. — animal like large heavily made cream coloured ass. — stripe on back also. — legs reminded me strongly of Zebra. — Mem. Quagga & L^d Morton¹ mare ringed.²

Owen³ says that Bell⁴ in Encyclop. of Anat. & Phys. describes a high-flying bat, which has the power of inflating its body like balloon. — by air cells connected with cheek pouches. —

Hunter's Animal Oeconomy⁵ p. 45 "One of the most general marks is, the superior strength of make in the males; and another circumstance, perhaps equally so is this strength being directed to one part more than another, which part is that most immediately employed in fighting "instances thighs of cock & neck of Bull. — is most common in vegetable feeders because males always *armed* in carnivora⁶ where females are peaceable — (Mem. Lucanus⁷ & Copris &c) In birds singing⁸ | of cocks settle point. (— do the females then fight for male & are merely most attracted). — singing best sign of most vigorous males (N.B. most strange cocks & hens being either alike or very different in recently allied genera. Guinea Fowl & Peacock) other birds display beauty of plumage. (The female (as Owen observes) in Raptorial birds largest.) —

p. 47⁹ is evidently the male which recedes from the species, all females being most like offspring. (how is this with those females which put on (like some waders) the bright plumage. — thinks Hence specific characters most perfect in hermaphrodites.

Fishes¹⁰ have no secondary characters. — p. 49¹¹ (wonderful case of Peahen taking feathers of Peacock & spurs — *no final cause here* & therefore different from Hunter. I should say females recede in organisation from specific character. — ¹² |

¹ George, Earl of Morton. *Phil. Trans. Roy. Soc.*, vol. 111, London 1821, p. 20. "A singular fact of natural history. Peculiarities of the progeny of an Arab horse from a mare that had previously bred with a Quagga."

² These words inserted in pencil.

³ Richard Owen. Personal communication.

⁴ Thomas Bell. *The Cyclopadia of Anatomy and Physiology*, London 1836, p. 594. "Cheiroptera". On p. 599;—"... In the genus Nycteris a curious faculty is observed, namely, the power of inflating the subcutaneous tissue with air ... These large spaces are filled with air at the will of the animal, by means of large cheek pouches ..."

⁵ John Hunter. *Observations on certain parts of the Animal Oeconomy*, London 1837, p. 45.

⁶ The words "because" to "carnivora" inserted in pencil.

⁷ *Lucanus cervus*, the stagbeetle in which species the male has enormous mandibles; in *Copris* the dung-beetle, males have large horns.

⁸ The page is slightly scored through: the figure 12 inserted in pencil.

⁹ John Hunter. *op. cit.*, p. 44 "An Account of an extraordinary Pheasant". On p. 47;—"... It is evidently the male which at this time at such respects recedes from the female, every female being at the age of maturity more like the young of the same species than the male is observed to be ... " On p. 49;—"... the male at this time receding from the female, and assuming the secondary properties of his sex ..."

¹⁰ Richard Owen. (In John Hunter, *ibid.*) footnote on page 47;—"This is not common to all animals of distinct sexes, for in fishes there is no great difference: nor in many insects: nor in dogs, as has already been observed; however, it is considerable in many quadrupeds, but appears to be most so in birds."

¹¹ John Hunter. *ibid.* p. 49;—"... had a favourite pied pea-hen which had produced chickens ... were astonished by her displaying the feathers peculiar to the other sex, and appeared like a pied peacock ..."

¹² In the centre of the page in pencil is the figure 2: at the foot the words "11 & Chapt. I. also *Latent Character*".

III†

147 : Hence,¹ also structure not really fitted for water, only habits & instincts — The young of the Kingfisher (p. 169) has the colour on its back bright blue. — thus young of many of the pies assume the metallic tints, such as Magpie, Jay, & perhaps all the rollers² — He says wherever metallic brilliancy is present in young birds, one may be sure cock & hen will be alike — I presume converse is not true for he says Hen & cock Starling alike, yet young ones *brown*. —

Is it male that assumes change, & is the offspring brought back to early type by mother? — do these differences indicate, species changing forms; if so domestic animals ought to show them. — anyhow not connected with habits |

148 According as child is like parent, so is *species* old : Hence young Kingfisher & pies, have long had their present plumage. How is it in Pigeons & fowls.???

Waterton³ p. 197 put 12 wild ducks eggs under common duck, the young crossed among themselves & I presume with common duck so often that it was impossible to say what was origin of any identical bird., for they were all colours " half wild, half tame, they came to the window to be fed, but still they had a wariness about them *quite remarkable* ", instance of old species transmitting so much longer its mental peculiarity.⁴ |

FOURTH NOTEBOOK

IV*

55 specify types & limits of variation, & hence indicate gaps. — by this means the laws probably would be generalized, & afterwards by the examination of the special cases, under which the individual stages in the series have been fixed, to study the physical causes. All Cuviers⁵ generalization of teeth to kind of extremities come under this head.

7th November When summing up argument against my theory, doubtless the presence of animals in the present orders (not so in S. America, however) is very remarkable & none discovered before them in any part of World. — Wealden to boot. — |

56 When one sees in Coralline powers of multiplication of individuals, & yet another means for individuals (mem : transportation will be answered) one look to analogy for causes in plants where *innumerable* individuals can be produced & yet sexual apparatus. —

¹ At the top of the page, in pencil, are the words " Sexual Selection " followed by the figure 12 and the words " Good Ch. 6 keep ", referring to the chapter on Natural Selection in Darwin's unpublished MS.

Across the page, written in pencil, are the words " If masculine characters added to species, we can see why Young and Female alike ".

² Edward Blyth. *Mag. Nat. Hist.*, vol. 2, London 1838, p. 351. " I. Analytic descriptions of the Group of Birds composing the Order Insesores Heterogenes. No. 1 — Rollers, Bee-Eaters, and Kingfishers; Todies, and Jacamars." On p. 354 ;—" . . . the young are excluded in a very rudimentary condition : . . . slowly elaborate a plumage, adult in appearance and texture, and which, scarcely differing from the brilliantly-tinted garb of the mature bird . . . the sexes differ slightly in the rollers and some *Halcyonidae*, wherein the young resemble the adult female . . . "

³ Charles Waterton. *Essays on Natural History chiefly Ornithology*, London 1838, p. 197. " Notes on the Habits of the Mallard ".

⁴ In the margin in pencil are the word " Wildness Reversion ". In the middle of the page are the figures 2 and 23 in pencil.

⁵ Georges Cuvier. *Recherches sur les Ossements Fossiles de Quadrupèdes etc.*, Paris 1816, tome 1, pp. 60–63. (" Principles of Correlation.")

My account¹ of *Circus cinereus* of the Falkland Isl^d is interesting as showing some change in habits before form. —² |

CORRIGENDA

Reference has already been made to the great difficulty experienced in transcribing the text of Darwin's Notebooks owing to indistinct formation of letters, abbreviations and slurred endings to words, telegraphic style without grammatical construction, and intercalation of phrases between lines. It was for this reason that no attempt was made to produce anything approaching a facsimile edition, but to give a text with the minimum of complication. Unfortunately, but as expected and stated, this has not been devoid of errors in transcription. Some of these are inadvertent omission of a word; others are faulty or doubtful readings. They have emerged as a result of re-examination of the text, comparison of the text of the First Notebook with that published³ by Professor Paul H. Barrett of Michigan State University, and a series of corrections kindly supplied by Dr Sydney Smith. The majority of these has been accepted, and a list of corrigenda drawn up, which is printed below in order to make the printed text of Darwin's Notebooks as accurate as possible.

CORRIGENDA TO TEXT

First Notebook on Transmutation of Species (C.U.L. Darwin MSS. 121)

The page-references are to manuscript pages.

2. *for* nor nurses are *read* nor nuns are
8. *for* in that case [it] seems is *read* in that case surely is
15. *for* from immersage *read* from immense ages
19. *for* how on this Ehrenberg *read* how is this Ehrenberg
21. *for* of will of animals *read* of will of animal
25. *for* ? we need think that *read* ? we need not think that
26. the words from " no " to " complicated " inclusive added subsequently
27. *for* bottom of branches deaden, — so that in mammalian tree *read* bottom of branches deader, — so that in mammalia birds
33. *for* less trifling differences *read* lesser trifling differences
37. *for* we can easily see *read* we can easy see
43. *for* such or few *read* just a few
48. *for* from Arabian count[ries] *read* from Arabian coast
51. the base of excised page 51 bears the words " the nearest species often "

¹ *Zoology of the Voyage of H.M.S. Beagle*, London 1841, Part III. Birds. Darwin's account of the habits of *Circus cinerius* in the Falkland Islands is on pp. 30 and 31. In the *Journal of Researches*, 1839 p. 66, it is referred to under the name *Polyborus Novae Zelandiae*.

² At the bottom of the page some undecipherable words have been added in pencil, and, in red pencil, the figures 5 and 23.

³ "A transcription of Darwin's First Notebook on 'Transmutation of Species'" edited by Paul H. Barrett, *Bull. Mus. Comp. Zool. Harvard*, vol. 122, 1960, pp. 245-296.

- 64. *for* individual cannot propagate *read* individual cannot procreate
- 65. *for* Bears and Foxes are *read* Bears & Foxes &c.
- 67. *for* probable that northern *read* probably true northern
- 68. *for* races of man *read* races of men
- 77. *for* of species if few genera *read* of species of few genera
- 81. *for* then plants on coral islets *read* Mem. plants on coral islets
- 82. *for* insures often mixing of *read* insures the mixing of
- 91. *for* copied with list *read* copied out list ; these words inserted in pencil subsequently
- 93. *for* or wishes to conquer *read* or instinct to conquer
- 95. *for* Man : species doubtful *read* Mem : species doubtful
- 98. *for* tone of ideas *read* tone of voice
- 103. *for* or what are barriers by *read* & what are barriers but
for volcanic soil at Galapagos *read* volcanic soil of Galapagos
- 111. *for* others [he] assumes created *read* other animals created
the words " or hints " inserted subsequently by Darwin, are in front of instead of
behind " considers " where they appear to belong
for or typical of changes *read* as typical of changes
- 112. *for* on three elements. p. 66 *read* or three elements p. 68
- 113. *for* S. H. *read* G. [S.] H.
- 114. *for* S. H. *read* G. [S.] H.
for giving laws and on them *read* giving laws and then
- 115. *for* quoted from Lyell *read* quote from Lyell
- 121. *for* and 30°-80° *read* dip 30°-80°
- 133. *for* S. Hilaire *read* G. [S.] Hilaire
- 136. *for* F[ox] Darwin *read* [Sir] F[rancis] Sacheverel] Darwin
for . . . *read* . . .
- 137. *for* but the shells *read* but then shells
- 140. *for* much larger, than the dom[estic] *read* much larger, than the dam
- 142. *for* asiatic types discernible *read* asiatic types discoverable
- 145. *for* often with same male *read* often with same female
for p. 23 *read* p. 28
- 148. *for* the two families *read* the two fine families
- 155. *for* would be on rays *read* would be in rays
- 170. *for* first approaching *read* fish approaching
- 175. *for* enlarged here very considerably *read* enlarged two very considerably
- 179. above " analogues " the words ' uses this word for similar ' inserted in pencil
- 192. *for* and on average *read* and daresays
- 193. *for* Jagonensis *read* Guyanensis
- 195. " No " is inserted in the margin in front of Mem.
- 206. *for* which wandered least *read* which has wandered least
- 208. *for* perfect insects *read* perfect insect
for and forms low hard to tell *read* and forms hard to tell
- 217. *for* we are ignorant *read* we are as ignorant
- 219. *for* character in offspring *read* character on offspring
for when elevated *read* where elevated

221. *for* In the flora *read* Is the flora
for transported then to *read* transported them to
223. *for* in Paris basin altered perhaps *read* in Paris basin allied to present
225. *for* the fact they are not *read* for the fact that they are not
for speculate on *read* speculate of
for and in current changes *read* and on amount changes
227. *for* have early been formed *read* have easily been formed
229. *for* grampus or an insect *read* fungus or an infusorian
230. *for* come from these *read* come from them
231. *for* the black have other mind *read* the black man other kind
236. *for* country where change *read* country when change
239. *for* cross breeding presents *read* cross breeding prevents
240. *for* these producing fertile hybrids *read* mere producing fertile hybrids
242. *for* migrating birds *read* migratory birds
246. *for* paleontologic table *read* meteorologic table
251. *for* M.D. *read* M.J.
263. *for* at what point at tree *read* at what part of tree
275. *for* Flox *read* Flax
280. *for* to say a little *read* to vary a little

Second Notebook on Transmutation of Species (C.U.L. Darwin MSS. 122)

268. *for* Roy St. Vincent *read* Bory St. Vincent

Printed page 80, line 14, *for* separated *read* separately.

ADDENDA AND CORRIGENDA TO BIBLIOGRAPHICAL REFERENCES.

In most cases the identification of a work as the one to which Darwin referred can only be conjectural where he did not give the precise reference himself. Additional references are therefore printed below to supplement those already given. Some of these references are derived from the edition of Darwin's First Notebook published by Professor Paul H. Barrett¹; others are due to the kindness of Dr. Sydney Smith.

Page references are to the *printed* pages of previous Numbers of this Volume of the Bulletin.

First Notebook on Transmutation of Species (C.U.L. Darwin MSS. 121)

Some of the page references to Lamarck's *Philosophie Zoologique*, Paris 1809, refer to the 1873 edition. The correct references to both editions are as follows:—

30. footnote 6 *read* tome 1, p. 55 (1873 ed. p. 73).
 „ 7 „ tome 1, p. 59 (1873 ed. p. 76).
 „ 8 „ tome 1, p. 99 (1873 ed. p. 112).
 „ 9 „ tome 1, p. 77 (1873 ed. p. 93).

¹ "A transcription of Darwin's First Notebook on 'Transmutation of Species'." edited by Paul H. Barrett, *Bull. Mus. Comp. Zool. Harvard*, vol. 122, 1960, pp. 245-296.

31.

footnote 6 *read* tome 1, p. 266 (1873 ed. p. 263).

„ 7 „ tome 1, p. 65, tome 2 p. 84 (1873 ed. tome 1 p. 82, tome 2 p. 78).

32.

footnote 1 *read* tome 2, p. 279 (1873 ed. p. 256).

„ 2 „ tome 2, p. 283 (1873 ed. p. 259).

„ 3 „ tome 2, p. 286 (1873 ed. p. 262).

42.

footnote 1 *read* tome 1, p. 57 (1873 ed. p. 75).

„ 2 Dr. Sydney Smith has identified the reference : J. E. Gray, "Remarks on the difficulty of distinguishing certain Genera of Testaceous Mollusca by their Shells alone, and on the Anomalies in regard to Habitation observed in certain Species", *Phil. Trans. Roy. Soc.*, vol. 125, 1835, p. 301.

43.

footnote 1 *cf* Barrett *op. cit.*, p. 285, note 7.

45.

footnote 2 *cf* Barrett *op. cit.*, p. 285, note 2.

50.

footnote 1. The references to Mr. Don probably refer to David Don rather than George Don. David Don was Librarian to the Linnean Society and author of numerous papers on the distribution and relations of plants. According to Dr. Sydney Smith, Darwin did much of his reading in the libraries of Learned Societies, and as Darwin's reference on the excised page 187 of the first Notebook, printed above, has definitely been identified with David Don, the other references to "Mr. Don" probably relate to him.

52.

footnote 4 *cf* Barrett *op. cit.*, p. 288, note 50.

55.

footnote 4. The anonymous author of the paper in the *Edinb. New Phil. Journ.* has been identified by Dr. Sydney Smith as Robert Jameson (1774-1854); also *cf* Barrett *op. cit.*, p. 289, note 66.

56.

footnote 3 *read* tome 1, p. 143 (1873 ed. p. 153).

57.

footnote 2 *cf* Barrett *op. cit.*, p. 288, note 50.

„ 4 *for* N. Baer *read* Karl Ernst von Baer.

„ 5. The reference is *not* to William Darwin Fox, but to Sir Francis Saverel Darwin (1786-1859), son of Erasmus Darwin (1731-1802) by his second wife Elizabeth Chandos-Pole. Francis Saverel Darwin was therefore half-brother to Dr. Robert Waring Darwin (1766-1848, Charles Darwin's father) and uncle of Francis Galton. He travelled

widely and lived at Sydrope, Derbyshire, where he kept wild animals, including wild boars. (Karl Pearson: *The Life Letters and Labours of Francis Galton*, Cambridge 1914, vol. 1 pp. 22 & seq.) Information kindly supplied by Lady Barlow.

58. footnote 2, 5, perhaps M. B. Wynn of the Preface to *The Breeders' and Fancier's Pedigree Book*. cf. p. 190 footnote 2 *supra*.
61. footnote 4 *for* P. 26 *read* xxvi
64. footnote 4. See correction to footnote 1, p. 50.
,, 6. See correction to footnote 1, p. 50.
,, 7. See correction to footnote 1, p. 50.
66. footnote 3 *read* tome 2 p. 279 (1873 ed. p. 256)
67. footnote 5 *cf.* Barrett *op. cit.*, p. 294, note 133.
70. footnote 1, line 3 *for* deathe *read* deaths
73. footnote 5 *cf.* Barrett *op. cit.*, p. 296, note 160.
,, 8 *cf.* Barrett *op. cit.*, p. 296, note 160.



DARWIN'S NOTEBOOKS
ON TRANSMUTATION OF
SPECIES. PART VI

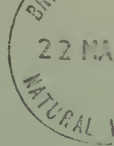
PAGES EXCISED BY DARWIN

Edited by
SIR GAVIN DE BEER, M. J. ROWLANDS and
B. M. SKRAMOVSKY

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
HISTORICAL SERIES

Vol. 3 No. 5

LONDON: 1967



DARWIN'S NOTEBOOKS ON
TRANSMUTATION OF SPECIES
PART VI

PAGES EXCISED BY DARWIN

Edited by

SIR GAVIN DE BEER, M. J. ROWLANDS and B. M. SKRAMOVSKY

Pp. 129-176

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
HISTORICAL SERIES

Vol. 3 No. 5

LONDON: 1967



THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), instituted in 1949, is issued in five series corresponding to the Departments of the Museum, and an Historical series.

Parts will appear at irregular intervals as they become ready. Volumes will contain about three or four hundred pages, and will not necessarily be completed within one calendar year.

In 1965 a separate supplementary series of longer papers was instituted, numbered serially for each Department.

This paper is Vol. 3, No. 5 of the Historical series. The abbreviated titles of periodicals cited follow those of the World List of Scientific Periodicals.

World List abbreviation :
Bull. Br. Mus. nat. Hist. (Hist. ser.).

© Trustees of the British Museum (Natural History) 1967

TRUSTEES OF
THE BRITISH MUSEUM (NATURAL HISTORY)

Issued 21 March, 1967

Price £1

DARWIN'S NOTEBOOKS ON TRANSMUTATION OF SPECIES PART VI.

PAGES EXCISED BY DARWIN

Edited by

SIR GAVIN DE BEER, M. J. ROWLANDS, & B. M. SKRAMOVSKY

INTRODUCTION

It was explained in the Introduction to Darwin's First Notebook on Transmutation of Species, that his method of working, when preparing to write his large book on Natural Selection which never appeared, but of which the *Origin of Species* was an abstract, was to cut out of his Notebooks those pages which contained the material of which he felt most in need. The result was that the Notebooks themselves were mutilated; but it was found that, as they stood, they provided so much useful information on the way in which Darwin's thoughts flowed, and the dates on which he made certain notes, that they were published. About a year later, some of the excised pages were found, partly among papers which Sir Robin Darwin had deposited with the Science Museum and subsequently transferred temporarily to the British Museum (Natural History), and partly in the Museum's library. In this manner 28 pages were recovered, the notebooks to which they had belonged determined, transcribed, edited, and published.

On the death of Mr. Bernard Darwin, his son Sir Robin Darwin deposited temporarily at the Museum a box of papers in which were found 202 more of the missing pages, and these form the subject of the present publication. The number of pages still missing now stands at about 70, and of these some may have been blank. The probability of their being discovered is small, and it is probable that as much has been collected of Darwin's Notebooks on Transmutation of Species as ever will be: 824 pages.

These newly found pages were the ones which Darwin himself considered to be the most important for his work, and it would be impossible to comment on them. An exception must, however, be made, in drawing attention to the pages (III, 134 & 135) which make it possible to determine which passage it was in Malthus's *Essay on the Principle of Population* which provided Darwin with what he required to prove that natural selection forced favourable adaptive variants into their ecological

niches, to know the exact date when this struck him, and to read the immediate effect which this had in his mind and led him to draft his most striking definition of natural selection.

The different notebooks to which the pages originally belonged were identified by the late Mr. A. C. Townsend and one of us (B.M.S.) by comparing the scissor-marks on the pages and on the stumps left in the notebooks.

Darwin classified his excised pages and marked many of them with large figures scrawled in black or red pencil. A table of these is given.

The editorial policy adopted with the excised pages is the same as that used with the Notebooks, but simplified as much as possible. No attempt has been made at facsimile reproduction, and if a reader should require to know whether any particular word or phrase was written in ink or in pencil, and possibly at a later date than the body of the text, he must consult the original manuscript pages, which are now in the Cambridge University Library.

It is a pleasure to record indebtedness to Sir Robin Darwin, Mr. H. R. Creswick, Mr. P. J. Gautrey, and particularly to Dr. Sydney Smith who not only gave us the benefit of his Transcription of difficult readings of the text and pointed out many of our mistakes, but very kindly supplied us with the text of additional excised pages which he found in the Cambridge University Library.

TABLE OF NUMBERS MARKED IN PENCIL MADE BY DARWIN ON PAGES
EXCISED FROM HIS NOTEBOOKS ON TRANSMUTATION OF SPECIES.

N.B. Some pages are marked with more than one number. They are all referred to here by the Notebook in Roman figures, followed by the manuscript page number in arabic figures.

Number

2. III. 114, 148.
3. II. 47, III. 12.
5. IV. 56.
7. II. 160, III. 102.
9. II. 253.
10. I. 190, II. 215, III. 54, IV. 124, 130, 170.
11. I. 70, 126, II. 71, 107, 110, 111, 142, 161, 185, 206, 222, III. 29, 55, IV. 25, 91.
16. III. 7, 136.
17. I. 30, 52, 189, II. 210, III. 31, 73, 85, 87, 105, 159, 173, IV. 123, 169.
18. I. 124, II. 23, 40, 94, 213, 227, IV. 139, 166.
19. I. 56, 154, 160, 177, 199, 201, 209, 234, 249, 255, II. 13, 18, 25, 27, 41, 50, 92, 109, 183, 205, 216, 225, 227, 249, 251, III. 31, 45, 61, 133, 151, IV. 10, 12, 19, 21, 42, 166, 173, 176.
20. I. 76, 107, 173, II. 93, 102, 148, 184, 238, 239, 241, 250, IV. 20, 104.
21. II. 257, IV. 88, 120.
22. IV. 6, 87, 126, 166
23. II. 50, 160, III. 148, IV. 56.

Pages excised by Darwin from his First Notebook on Transmutation of Species

I

29 ... not. —

Monad has not definite existence. —

There does appear some connection shortness of existence, in perfect species from many changes and base of branches being dead from which they bifurcated. — |

30 Type of Eocene with respect to Miocene of Europe?

Loudon. Journal of Nat History¹. July 1837. Eyton of Hybrids propagating freely. |

51 the nearest species often come [from] very remote quarters. (N.B. if Plata Partridge or Orpheus was introduced into Chili in present state it might continue & thus two species be created) & live in same country. How in propagation of wolf & Dog.^{1A} (because being believed same species) if they do not breed readily point in view. — ?whether highly domesticated animals like races of man. — |

52 M. Flourens.² Journal des Savants. April 1837. p. 243 it is said as well known fact that “serin avec le chardonneret, avec la linnotte, avec le verdier” & for silver gold & common pheasants & fowls. — “on sait que le ‘métis’ du loup et du chien, que celui de la chèvre et du bœuf, cessent d’être féconds dès les premières générations” go back to type of either animal when crossed with it. — |

55 There certainly appears attempt in each dominant structure to accom[m]odate itself to as many situations as possible. — Why should we have in open country a ground woodpecker. — do. parrot. — a desert Kingfisher. — mountain tringas. — upland goose. — water chionis, water rat with land structures; carrion eagles. — This is but carrying on attempt at adaptation of each element. —

May this not be explained on principle of animal having come to island where it could increase, but there were causes to induce great change. like the Buzzard which has changed into Caracara at the Galapagos. law of chance would cause this to have happened in all but less in water birds. — |

56 Fernando Noronha *Ophyessa bilineata* (Gray) new species belonging to true American genus.

Waterhouse³ says he is certain, that in insects, each family, however many there may be, represent every other, for instance in *Heteromera*, you have representatives (which at first would be mistaken for) *Carabidae*, *Chrysomela*, *Scarabeidae*, & *Longicornes*. —

¹ Thomas Campbell Eyton. “Some Remarks upon the Theory of Hybridity”. *Mag. Nat. Hist.*, N.S. vol. 1, 1837, p. 357: “a hybrid male and female, derived from the Chinese and common goose, had been productive *inter se*”

^{1A} John Hunter, *Observations on certain parts of the Animal Oeconomy*, with notes by Richard Owen, London 1837, “Observations tending to show that the Wolf, Jackal and Dog are all of the same species”.

² Marie-Jean-Pierre Flourens. Review of Cuvier’s *Recherches sur les ossements fossiles*, in *Journal des Savants*, avril 1837, p. 243.

³ George Robert Waterhouse. “Description of some new species of exotic insects”, *Trans. Entom. Soc. Lond.*, vol. 2, pp. 188–196. On p. 189:—“This collection consists chiefly of Coleopterous insects, and among them I had most of the curious *forms* observed in the section *Heteromera*, — my object being to show that the species thus selected were analogous representations of other groups of beetles; that is to say, that they departed from their own group in certain characters of form, colour, &c., and that in these respects they appear to have borrowed (if I may use such a term) the characters of other groups of the same order, to which they bear such a resemblance that they might at first sight be mistaken for species belonging to those groups”.

Again taking a subdivision of Heteromera |

69 tendency to keep to one line.^{3A} Dr. Smith⁴ says very close species generally frequent slightly different localities, so that they become useful to know what is species. —
70 In proof that structure is simple adaptation, armadilloes & | & Megatherium each with same kind of coat. — If we could tell, I do not doubt even colour hereditary in time and in space (Mem. Galapagos). Little wings of Apteryx. *Dacelo* & *Kingfisher* same colours |

75 relation of types in two countries direct relation to facilities of communication.

Have *races* of Plants ever been crossed really, if there is any difficulty in such marriages or offspring show tendency to go back — there is an end to species. — |

76 Brown⁵ Appendix. A most remarkable observation of Mr Brown about peculiarities of Flora on East & West ends of New Holland. diminishing towards centre (p. 586) — Parallel 33°–35° some of forms reduce towards Northern Eastern end & die away & partake of Indian character. |

107 Ed. New. Philosoph. J. No. 3 p. 207 “It is not generally known that Ireland possesses varieties of the furze, broom, & yew very different from any found in great Britain. British varieties are also found in Ireland.”⁶ — |

108 There must be progressive development; for instance none ? of the vertebrata could exist without plants & insects had been created; but on other hand creations of small animals must have gone on since from parasitical nature of insects & worms. — In abstract we may say that vegetables & most of insects could live without animals |

123 Race permanent, because every trifle hereditary, without some cause of change; yet such causes are most obscure without doubt: vide cattle: The grand fact is to establish whether in crossing very opposite races whether you would expect equal fertility. ditto in Plants. |

124 It will be well to refer to Chamisso⁷ Vol. III, p. 155 about quantities of seeds in sea: also Holman⁸: Keeling these are most important facts. — As soon as island large enough for land birds, seeds picked from the beach by the birds: most seeds germinating. — |

125 It would be curious experiment to know whether soaking seeds in salt water &c has any tendency to form varieties?

^{3A} Andrew Smith. “Observations relating to the Origin and History of the Bushmen”, *The South African Quarterly Journal*. No. 1, 1830, pp. 171–189.

⁴ Andrew Smith. “A description of the birds inhabiting the South of Africa”, *S. Afr. Quart. Journ.*, No. 3, 1830, pp. 225–241; on p. 237: — “when a doubt can justly exist as to identity, to consider the objects, especially if their habitats be very far apart, as distinct species”.

⁵ Robert Brown. Appendix No. III in *A Voyage to Terra Australis*, by Matthew Flinders, vol. 2, 1814, pp. 533–613; General Remarks, geographical and systematical, on the Botany of Terra Australis; p. 586: — “nearly half the Australian species of plants, at present known, have been collected in a parallel included between 33° and 35° latitude; and it appears from the preceding observations on the several natural orders, that a much greater proportion of the peculiarities of the Australian Flora exists in this, which I have therefore called the *principal parallel*. . . Within the tropic at least on the East coast, the departure from the Australian character is much more remarkable, and an assimilation nearer to that of India than of any other country takes place”.

⁶ Robert Jameson, editor of *Edinburgh New Philosophical Journal*, vol. 2, 1826, Scientific Intelligence — Botany, p. 207: — “Irish Furze, Broom, and Yew”.

⁷ Adelbert von Chamisso, in Otto von Kotzebue, *A Voyage of Discovery into the South Sea and Beering's Straits*. . . translated by H. E. Lloyd, London 1821.

⁸ James Holman. *Voyage round the World*, London 1834.

Ed. N. Phil. J.⁹ Moose found in Virginia p. 325 July 1828. Animal now confined to extreme North. — do p. 326 2 Fossil species of Ox in N. America¹⁰; as well as 2 recent. |

- 126 See Geol. Proc.¹¹ p. 569 1837. Account of wonderful fossils of India. Great monkeys¹² & p. 545.

Mr. Johnston¹³ says Mag of Zooly & Bot p. 65 vol II talking of annelidae. — The fact is an additional illustration of that axiom in Natural History that all aberrant & osculant groups are not only few in species, but every two or three [in] them form genera

this is from unfavourable conditions there are many gaps & those forms which nevertheless have produced species, have |

- 153 See R.N.¹⁴ p. 130 speculations on range of allied species. p. 127 p. 132. There is no more wonder in extinction of individuals than of species.

Paris Tertiary Shells in India!¹⁵ ? A¹⁶ p. 28

- 154 Dr Beck¹⁷ & Lyell.¹⁸ most curious law of species few in Arctic in proportion to genera. agrees with late production of those regions & consequently | not many get multiplied: N.B. How does this bear with law referred to by Richardson¹⁹ in Report about each genus having its parent type in hotter parts of world.

Is monkey peculiar to C. de Verd Is.? No. Macleay²⁰ passage given in Congo Expedition.

We need not expect to find varieties intermediate between every species. — Who can find trace or history of species between |

⁹ *Edinburgh New Philosoph. Journ.* vol. 5, 1828, p. 325, "Discovery of a fossil walrus or sea-horse, in Virginia.

¹⁰ J. E. Dekay. "On a fossil ox from the Mississippi", *Edinburgh New Philosoph. Journ.*, vol. 5, 1828, p. 326.

¹¹ Sir Proby T. Cautley & Hugh Falconer. "On the remains of a fossil Monkey from the Tertiary strata of the Sewalik Hills in the north of Hindostan", *Proc. Geol. Soc.*, vol. 2, No 51, 1837, p. 568.

¹² Sir Proby T. Cautley & Dr Royle: in an extract from a letter in *Proc. Geol. Soc. Lond.* vol. 2, No. 51, p. 545 " . . . The animal must have been much larger than any existing monkey . . ."

¹³ George Johnston. "Miscellanea Zoologica. The British Ariciadea". *Mag. Zool. Bot.* vol. 2, 18., p. 65:—"not only comparatively few species, but at the same time these species so dissimilar among themselves that each, or every two or three of them, will be found to have characters which are properly generical".

¹⁴ Sir John Richardson. *Report on North American Zoology* (6th Report of the British Association for the Advancement of Science, 1836). An offprint was given by the author to Darwin and was heavily annotated by him; now in Cambridge University Library. Information kindly supplied by Dr Sydney Smith.

¹⁵ Sir Charles Lyell. *Principles of Geology*, 5th ed. Loudon, 1837, vol. 3, p. 378-379:—"The Recent Strata form a common point of departure in all countries . . . Thus, for example, if strata should be discovered in India or South America, containing the same proportion of recent shells as are found in the Paris Basin, they also might be termed Eocene".

¹⁶ Reference untraced.

¹⁷ Heinrich Henrichsen Beck. "Notes on the Geology of Denmark", *Proc. Geol. Soc.* vol. 2, 1838, p. 217.

¹⁸ Sir Charles Lyell. *Principles of Geology*, 5th ed., London 1837, vol. 3. See also Alexandre de Humboldt, *Dictionnaire des sciences naturelles*, Paris 1820, tome 18, p. 422; table: "Sur les lois que l'on observe dans la distribution des formes végétales".

¹⁹ Sir John Richardson, *Report on North American Zoology*, (*Rep. Brit. Assoc. Adv. Sci.* [Bristol 1836] vol. 5, 1837, pp. 121-224.

²⁰ Reference uncertain. Capt. Tuckey's *Narrative of an expedition [to explore] The River Zaire usually called the Congo, in South Africa in 1816*. John Murray 1818. p. 36. "The only species here is the green monkey (*Cercopithecus sabaeus*)."

- 159 Von Buch²¹ says from Humboldt²² in Laponia genera to species 1.2, 3 — From Mackenzie²³ Iceland then 144 genera & 365 species of plants not cryptogamic 1.2, 53.—

In known varieties there is analogy to species & genera. — for instance three kinds of greyhound. — In plants do. the seeds of marked varieties produce no difference. if they do. — there probably will be this relation also. Yes. Fox.²⁴ |

- 160 The creative power seems to be checked when islands are near continent : compare Sicily & Galapagos!! —

Some of the animals peculiar to Mauritius are not found at Bourbon Zoolog. Proceedings²⁵ A.D. 1832 p. 111 |

- 173 Roxburgh²⁷ list of plants in Beatson's²⁸ St Helena — Galapagos — Juan Fernandez — Falkland Islds — Kerguelen land. — Phillips.²⁹ Lardner Encyclop. insists on analogy between Australia and fossils of Oolitic series. does not appear to me very strong. what is *Osteopora platycephalus*. (Harlan) found on Delaware is it Edentate? Phillips³⁰ Lardner p. 289 |

- 174 It is certain that North American fossils bear the closest relation to those now living in the sea. — See Rogers³¹ report to Brit. Assoc. on *N. American Zoology* — |
177 and milk — Fox³² tells me that it is generally said. = = How came first species to go on. There *never* were any constant species. Both males & females lose desire.

Native dog not found in V. Diemen's land J. de Physique Tom 59 p. 467 Peron.³³ |

- 178 G. St Hilaire³⁴ has written "Opusculé entitled *Paleontographie*" developing his ideas on passage of forms. — Deshayes³⁵ states Lamarck³⁶ priority refers to introduction to *Animaux sans Vertebres* as latest authority — The case of the tail[less] cat of the Isle of Man mentioned in Loudon³⁷ analogue of Bloodhound. — |

²¹ Leopold von Buch. *Description physique des Iles Canaries*, traduit de l'allemand par C. Bourgeois. Paris 1830. Proportion of genera to species : in North Africa 1 to 4.2 ; in Canary Islands 1 to 1.46 ; on St Helena 1 to 1.5. According to Humboldt, in France 1 to 5.7 ; in Lapland 1 to 2.3.

²² Alexander von Humboldt. *De distributione geographica plantarum secundum coeli temperiem et altitudinem montium, prolegomena*, Lutetiae Parisiorum 1817.

²³ Sir George Stewart Mackenzie. *Travels in the Island of Iceland*, Edinburgh 1812, Chapter VIII, Botany, pp. 350-356.

²⁴ William Darwin Fox. Probably personal communication.

²⁵ Julien Desjardin. *Proc. Zool. Soc.* 1832, p. 111 :— "their animals are not universally the same, some species being met with in the one which never occur in the other".

²⁷ William Roxburgh. List of Plants relative to the Island of St Helena, in Alexander Beatson, *vide infra*, following footnote.

²⁸ Alexander Beatson. *Tracts relative to the Island of St Helena*, [London], 1816.

²⁹ John Philips. Treatise on Geology, in *Lardner's Cabinet Cyclopaedia*, London 1837.

³⁰ *ibid*.

³¹ Henry Darwin Rogers. "Report on the Geology of North America", *Rep. Brit. Assoc. Adv. Sci.* Edinburgh 1834 [1835], vol. 3, pp. 1-66.

³² William Darwin Fox. Probably personal communication.

³³ François Péron, "Sur quelques faits zoologiques applicables à la théorie du globe, lu à la Classe des Sciences physiques et mathématiques de l'Institut National". *Journ. de Physique, de Chimie, d'Histoire naturelle et des Arts*, tome 59, 1804, p. 463 ; Première section : observations zoologiques qui peuvent faire douter de la réunion primitive de la Nouvelle-Hollande à la Terre de Diemen. On p. 466 :— "Le chien . . . n'existe pas sur la Terre de Diemen".

³⁴ Etienne Geoffroy-Saint-Hilaire. See following footnote. The basic idea is contained in his *Principes de philosophie zoologique*, Paris 1830, p. 214.

³⁵ Gérard-Paul Deshayes. *Bull. Soc. géol. France*, tome 4, 1833-4. p. 99 :— "M. Deshayes répondant à ce que M. Geoffroy-Saint-Hilaire a exposé dans la séance précédente en présentant son opusculé intitulé : *Paleontographie*, réclame en faveur de notre célèbre Lamarck la priorité de cette idée, que les animaux sont modifiés dans leur organisation par les circonstances ambiantes".

³⁶ Jean-Baptiste de Lamarck. *Philosophie zoologique*, Paris 1809 ; also *Histoire naturelle des animaux sans vertèbres*, Paris 1815-1822.

³⁷ Edward Blyth. "An attempt to classify the 'Varieties' of animals, with observations", *Loudon's Mag. Nat. Hist.* vol. 8, 1835, p. 40. On p. 47 :— tailless cats . . . are other striking examples of *true varieties*".

- 189 on hybrids between grouse & Pheasant.³⁸ Magazine Zoolog. & Botany vol. 1, p. 450.

There is in nature a real repulsion amounting to impossibility holds good in plants between all different forms ; therefore when from being put on island & fresh species made parents do not cross — we see it even in men ; thus possibility of Caffers & Hottentots coexisting proves this. — but when man makes variety then are vitiated. — this barely applies to plants |

- 190 Female pig apt to produce monsters in Isle of France.³⁹ — Madagascar oxen with hump.⁴⁰ — p. 173 Voyage par un Officier du Roi

Mem. Capt. Owen's⁴¹ story of cats on West coast of Africa. — changing hair. The Edinburgh Journal of Natural History.⁴² Preface appeared good with facts about changes when animals transported. |

- 199 Bustards in Germany. —

Athenaeum⁴³ No. 537 Feb. 1838 p. 107. Mr. Blyth states that all genera of birds in N. America & Europe, which have not their representative species in each other, are migratory species from warmer countries. When will this paper be published it will be curious. — Some general statement about mundine & confined genera. — |

- 200 Lyell⁴⁴ has remarked about no confined species in Sicily.

Jan. 1838 l'Institut.⁴⁵ Bats. in Eocene beds very like present species. p. 8? are mundine forms longest persistent ?? do. — The most perfect Plants Composit.⁴⁶ — !! *good those which have undergone most metamorphosis* is this applicable to insects &c. &c. ? — p. 23 do. — On animal—Confervae.⁴⁷ p. 23 |

³⁸ William Thompson. "On hybrids produced in a Wild state between the Black-Grouse (Tetrao tetrix) and Common Pheasant (Phasianus colchicus)", Mag. Zool. Bot., vol. 1, 1836-1837, p. 450.

³⁹ Jacques-Henri Bernardin de Saint-Pierre. *Voyage à l'Isle de France, à l'Isle de Bourbon, au Cap de Bonne-Espérance, &c., Avec des Observations nouvelles sur la nature & sur les Hommes, par un Officier du Roi*, Amsterdam 1773, tome 1, p. 247 :— "... celle du cochon ... La femelle de cet animal est sujette dans cette Isle à produire des monstres".

⁴⁰ Bernardin de Saint-Pierre, op. cit., tome 1, p. 246 :— "des boeufs dont la race vient de Madagascar. Ils portent une grosse loupe sur leur cou".

⁴¹ William Fitzwilliam W. Owen. *Narrative of a Voyage to explore the shores of Africa, Arabia, and Madagascar* . . . London 1833.

⁴² *Edinb. Journ. Nat. Hist.* No 2, 1835, p. 5 :— "We are astonished when we study their geological relation in any particular district or country ; their geographical distribution, relatively to the world itself, or their migration from one country to another ; their connection with climate, there being domestic plants, which follow man in his improvement and change of soil, or wanderers seeking to inhabit distant regions, formerly uninhabited by their kinds, or by their being social and living, like man, in large communities ; their abundance or rarity ; their mode of propagation ; their natural enemies, or more kindly friends."

⁴³ Edward Blyth. *Athenaeum*, No. 537, February 1838, p. 107 :— "... that those North American birds which have no generic representative in Europe, and those European genera which have no species proper to America are, almost without exception, migratory, belonging to types of forms characteristic of those regions where they pass the winter".

⁴⁴ Sir Charles Lyell. *Principles of Geology*, 5th ed. London 1837, vol. 3, p. 444 :— "The newly emerged surface, therefore, must, during the modern zoological epoch, have been inhabited for the first time by the terrestrial plants and animals which now abound in Sicily . . . The plants of the flora of Sicily are common, almost without exception, to Italy or Africa, or some of the countries surrounding the Mediterranean ; so that we must suppose the greater part of them to have migrated from pre-existing lands".

⁴⁵ Henri-Marie de Blainville. *L'Institut*, 1838, p. 6, Zoologie, Chauve-Souris. On p. 8 :— "ces familles existaient avant la formation des terrains tertiaires . . . si anciennes ne différaient que fort peu, si même elles différaient des espèces actuellement vivantes dans les mêmes contrées".

⁴⁶ J. Meyen. *L'Institut*, tome 6, 1838, Physiologie végétale ; on p. 23 :— "M. Fries décide que les Composées sont les plantes les plus complètement développées".

⁴⁷ *ibid.* "M. Mohl a fait connaître d'abord ses observations sur le Conferva".

201 p. 267 Dela Bèche⁴⁸ Geolog. Researches. facts of salt-water shells living in absolutely fresh water. Origin of fresh-water genera? The absence of lime in Plutonic & Volcanic rocks most remarkable. — ? Have the changes been so slow, that all have existed for ages as metamorphic & therefore according to Lyell's⁴⁹ doctrine removed ?? |

202 Is the prevalence of Coniferous Woods before Dicotyledenous a fact analogous to reptiles before mammalia

Think about Miocene fossils some species being recent agreeing with Senegal. whilst Crag according to Beck⁵⁰ has none recent yet genera same. — Speculate on multiplication of species by travelling of Climates & the backward & forward introduction of species. — |

209 Bolivian human species⁵¹? —

Small new animal mentioned from Fernando Po.⁵² Zoolog. Proceedings October (?) 1837 [Contrast New Zealand with Tasmania].^{52A} The reason why there is not perfect *gradation* of change in species as physical changes are *gradual*; is this if after isolation (seed blown into desert or separation of mountain chains &c.) the species have not been *much* altered they will cross (perhaps more fertility & so make that sudden step. species or not. |

210 A plant submits to more individual change, (as some animals do more than others & cut off limbs & new ones are formed) but yet propagates varieties according to same law with animals ??

Why are species not formed during ascent of mountain or approach of desert? — because the crossing of species less altered prevents the complete adaptation which would ensue |

233 *Dr Smith's information.*⁵³ Long Horned (very) aboriginal at Cape crossed with English Bull. offspring very like common English. — Hottentots say great tailed sheep aboriginal at Cape & a thinner tailed kind farther inland. —

N.B. There is division of snakes with hinder teeth perforated for poison channels, but not having them. instance of useless structure.

Smith⁵⁴ thinks several species of Rhinoceros range from Abyssinia to extreme South coast. Elephant he believes is mentioned by old writers on extreme Northern

234 coast. | Hippopotamus do. — Giraffe do. —

⁴⁸ Sir Henry Thomas de La Bèche. *Researches in Theoretical Geology*, London 1834, p. 267 :— "*Voluta magnifica* is known to live high up in the brackish waters near Port Jackson in Australia, and an *Arca* inhabits the freshwater of Jumna, near Hamirpur, 1000 miles from the sea".

⁴⁹ Sir Charles Lyell. *Principles of Geology*, 5th ed. London 1837, vol. 3, p. 302 :— "The constant transfer, therefore, of carbonate of lime from the inferior parts of the earth's crust to its surface, must cause at all periods and throughout an indefinite succession of geological epochs, a preponderance of calcareous matter in the newer, as contrasted with the older formations".

⁵⁰ Heinrich Henrichsen Beck. "Notes on the Geology of Denmark", *Proc. Geol. Soc.*, vol. 2, 1835-1836, pp. 217-220.

⁵¹ Joseph Barclay Pentland. "On the Ancient inhabitants of the Andes", *Rep. Brit. Assoc. Adv. Sci.*, 1834, p. 624 :— "The remains of this race are found in ancient tombs among the mountains of Peru and Bolivia".

⁵² *Proc. Zool. Soc.*, vol. 5, 1837, p. 101 :— "Mr Martin exhibited a new Bat from Fernando Po". (Probably William Martin).

^{52A} A pencil interpolation.

⁵³ Andrew Smith. Personal communication.

⁵⁴ Andrew Smith. *Illustrations of the Zoology of South Africa*. 1. Mammalia, London 1838, gives the range of the rhinoceros.

Range of East Indian Rhinoceros (?) — Some paper in Institut⁵⁵ on range of Bos in India. — Range of Zebra ? —

The crocodile & Tortoise former inhabits of Mauritius Freycinet⁵⁶ Voyage. agrees with *several mammalia* being peculiar (?)

If Henslow⁵⁷ discusses possibility of seeds of Keeling standing transport. — Get him to discuss those mentioned by Lesson⁵⁸ & Chamisso.⁵⁹ — |

249 Mr. Waterhouse⁶⁰ has most curious facts about the distribution of Lemurs in Madagascar, on neighbouring islets & a sub-genus in Southern Africa. In same manner, Cuscus, (a *sub* genus of Phalangista New Holland form) is found in many islands Celebes, Waygiou &c. &c. (See Lyell⁶¹ Vol. III p. 30) different species in different isld. (as far East as New Ireland. See Coquille Voyage⁶²). Waterhouse⁶³ remarks Australian Fauna so far. Indian all the rest. Timor according to mountain chain ought to be Australian ? — Mr. Gould⁶⁴ has been struck with similar extension of forms in Birds. — |

250 Waterhouse⁶⁵ thinks two main divisions of cats. Tortoise shell & grey — banded. ?species? thinks offspring of cats sometimes heterogenous. — Australian dog jumped into tub leaving only nose above it — pulled bell.⁶⁶ — It is most curious to observe, that all the species of mice in S. America which were hard to distinguish came from closely neighbouring localities. — Institut⁶⁷ 1838 p. 38 account of fossils of Sewalick India *Monkeys of old World* Crocodiles Anoplotherium. — |

255 T. Carlyle⁶⁸ saw with his own eyes new gate opening towards pigs. — latch on other side. — Pigs put legs over, & then with snout lift up latch & back. —

⁵⁵ reference untraced.

⁵⁶ Louis de Freycinet. *Voyage autour du monde . . .* Paris 1825–1839. Freycinet also edited the 2nd edition of François Péron's *Voyage de découvertes aux Terres Australes*, Paris 1824, referred to above by Darwin in connexion with Mauritius.

⁵⁷ John Stevens Henslow. "Florula Keelingensis. An Account of the native plants of the Keeling Islands", *Ann. Nat. Hist.* vol. 1, 1838, p. 337:—"Mr Darwin . . . presented me with the plants which he collected, together with his memoranda respecting them, I have thought that a list of the species, accompanied by a few remarks, might be of interest; and chiefly as serving to point out a set of plants whose seeds must be provided in a very eminent degree with the means of resisting the influence of sea water". It is interesting to note this early date at which Darwin was interested in the viability of seeds immersed in sea water, on which he made experiments twenty years later.

⁵⁸ René Primevère Lesson. In Louis Isidore Duperrey, *Voyage autour du Monde . . .* Paris 1826–1830, Zoologie is by Lesson and P. Garnot, tome 1, 1826.

⁵⁹ Adelbert von Chamisso. In Otto von Kotzebue, *A Voyage of Discovery into the South Sea and Beering's Straits*, London 1821.

⁶⁰ George Robert Waterhouse. Probably personal communication.

⁶¹ Sir Charles Lyell. *Principles of Geology*, 5th ed. London 1837, vol. 3, p. 30:—"Phalangista vulpina inhabits both Sumatra and New Holland, the P. ursina is found in the island of Celebes; P. chrysorrhos in the Moluccas; P. maculata, and P. cavifrons, in Banda and Amboyna".

⁶² Louis Isidore Duperrey, *Voyage autour du Monde . . .* Zoologie par MM. Lesson et Garnot, tome 1, Paris 1826, p. 158:—"Couscous blanc, *Cuscus albus* . . . Kapoune des Nègres du Part-Praslin, à la Nouvelle-Irlande".

⁶³ George Robert Waterhouse. Probably personal communication.

⁶⁴ John Gould. *A Synopsis of the Birds of Australia and adjacent Islands*, London 1837–1838.

⁶⁵ George Robert Waterhouse. Probably personal communication.

⁶⁶ Reference untraced.

⁶⁷ Hugh Falconer & Sir Proby T. Cautley. "Sur de nouvelles espèces fossiles de l'Ordre de Quadrumanes", *L'Institut* tome 6, 1838, p. 37. Also *Proc. Geol. Soc.* vol. 2, 1837, p. 544:—"extract of a letter, dated Saharumpore 18th November 1836 . . . Captain Cautley and Dr Royle . . . of the finding of the remains of a quadrumanous animal in the Sewaliks, or Sub-Himalayan range of mountains. An Astragalus was first found, but latterly a nearly perfect head, with one side of the molars and one orbit nearly complete. The animal must have been much larger than any existing monkey, and allied to Cuvier's Cynocephaline group".

Frogs attempted to be introduced to isle of France.⁶⁹ p. 170 Fish introduced, Hump backed race of cows from Madagascar.⁷⁰ — p. 173 Vol. I. Voyage de France par un Officier du Roi. —

Mackenzie⁷¹ Travel. p. 280 says cattle in Iceland are very like the largest of our highland sort, except in one respect, that those of Iceland are seldom seen with horns.
 256 p. 341 Black Fox sometimes introduced by ice⁷² | very few pigs. — birds mentioned but few. — There was notice in Report of British Association of 1838 (Newcastle) about somebody who had made great collection of birds of Iceland.⁷³ — Mr. Gaimard,⁷⁴ however, will settle this. —

Waterhouse⁷⁵ says he is certain there are local varieties of colour & size but not forms (?) of animals. — He says Stephen⁷⁶ says he can at once tell by general colouring a group of *Nebria complanata* from Devonshire from another from Swansea. — Again Waterhouse⁷⁷ finds certain varieties of *Harpalus* common at Southend, but absent from near London. — Dr Smith,⁷⁸ he says, is deeply |

⁶⁸ Thomas Carlyle.

⁶⁹ Bernardin de Saint-Pierre. *Voyage à l'Isle de France* . . . Amsterdam 1773, tome 1, p. 170, fish and frogs introduced to Isle de France (= Mauritius).

⁷⁰ *ibid.* p. 246.

⁷¹ Sir George Stewart Mackenzie. *Travels in the Island of Iceland* Edinburgh 1811, p. 280 :— "The cattle, in point of size and appearance, are very like our highland sort, except in one respect, that those of Iceland are seldom seen with horns".

⁷² *ibid.*, p. 341 :— "Two distinct varieties of fox present themselves in Iceland: the arctic, or white fox (*Canis lagopus*), and one which is termed the blue fox (*Canis fuliginosus*) and varies considerably in the shades of its fur, from a light brownish or blueish grey . . . Horrebow mentions the black fox is sometimes brought over on the ice".

⁷³ John Hancock. "Remarks on the Greenland and Iceland Falcons" (Collectors: G. C. Atkinson & P. Procter), *Rep. Brit. Assoc. Adv. Sci.* vol. 7, 1839, p. 106.

⁷⁴ Paul Joseph Gaimard. Reference to work which ultimately appeared as "Liste des oiseaux qui se rencontrent en Islande avec des remarques sur leur présence dans cette île par M. Raoul Angles" in *Voyage en Islande et au Groenland* . . . Paris 1851. The voyage took place in 1834.

⁷⁵ George Robert Waterhouse. Probably personal communication.

⁷⁶ James Francis Stephens. *Zoological Journal*, vol. 1, 1825, p. 448, Art. 57, "Some observations on the British Tipulidae, together with descriptions of the Species of *Culex* and *Anopheles* found in Britain". A footnote on p. 451 refers to a collection of *Nebria* made in Devonshire by Dr William Elford Leach.

⁷⁷ George Robert Waterhouse. Probably personal communication.

⁷⁸ Andrew Smith.

Pages excised from Darwin's Second Notebook

II

- 13 Falkner¹ Patagonia no description of wild animals, nor in Dobritzhoffer² Abipones. —

Voyage de l'Astrolabe Zoologie³ p. 60 Vol. I Cynocephalus niger comes from the Moluccas Matchian & Celebes. Amboina, Viverra Zibetha.⁴ All the Moluccas, Waggiou, New Guinea, New Ireland, have phalangista⁵ which differ in form & head & colour from those of New Holland. — The New Holland species are not found in the Archipelago. — Former statements to such effects false. In New Guinea a Kangaroo D'Aroe (Didelphus Bruni)⁶ which as yet had only been found in isle of Aroe & Solor. |

- 14 likewise Vol. I new species of Parameles,⁷ which joined to Casoars, perroquets, establishes its Zoolog alliance with New Holland. The Barbaroussas⁸ (when young very like the Siam race with Long nozzle & few hairs) inhabits Celebes & few of the larger islands. — Antelope in Celebes. Bourou⁹ new species of Aries Cervus moluccensis different from that of the Mariana islands & at Amboina. — I fancy there is marked wild breed of oxen at Java. p. 140 calls it Bos leucoprymnus.¹⁰ does not say whether wild or not. p. 156 Parroket with stiff tail like woodpecker.¹¹ — |

- 17 The changes in species must be very slow owing to physical changes slow & offspring not picked. — as man do when making varieties. —

Voyage of Coquille.¹² Zoolog. p. 19 Tapir de Courrucous et rupicole vert instances of American forms in East. Ind. Archipelago. — Raffles,¹³ Horsfield,¹⁴ Diard,¹⁵ Duvaucel,¹⁶ Leschenault,¹⁷ Kuhl,¹⁸ Van-Hasselt,¹⁹ Reinwardt,²⁰ Forrest²¹ authors on E. Indian Arch.

Borneo & Sumatra both seem to have elephant & has oranges.²² Tapir common to Sumatra & Molucca. Borneo & Molucca & Cochin China are said to have orang-

¹ Thomas Falkner. *A Description of Patagonia and the adjoining parts of South America*, Hereford, 1774.

² Martinus Dobritzhoffer, *Account of the Abipones*, London, 1822.

³ Jean René Quoy et Joseph Paul Gaimard, *Voyage de découvertes de l'Astrolabe, Zoologie*, Paris, 1830, tome 1, p. 60.

⁴ *ibid.*, p. 61.

⁵ *ibid.*, p. 62.

⁶ *ibid.*, p. 62.

⁷ *ibid.*, p. 62: "petit kangaroo à queue courte".

⁸ *ibid.*, p. 63: "on les confond avec les petits cochons . . . de Siam".

⁹ *ibid.*, p. 64: "à Java un boeuf remarquable par sa grande taille".

¹⁰ *ibid.*, p. 140.

¹¹ *ibid.*, p. 156: "queue à plumes fortes et usée comme celles des Pics".

¹² René Primevère Lesson et Prosper Garnot, *Voyage autour du Monde . . . sur . . . La Coquille. Zoologie*, Paris, 1826, p. 19.

¹³ Sir Thomas Stamford Raffles, *History of Java*, London, 1817.

¹⁴ Thomas Horsfield, *Zoological Researches in Java and the neighbouring islands*, London, 1824.

¹⁵ Diard is mentioned in the *Dictionnaire Larousse*, under "Duvaucel" as a French naturalist whom the latter met on his expedition, in 1818.

¹⁶ Alfred Duvaucel (1792-1824).

¹⁷ Jean Leschenault de la Tour (1773-1826).

¹⁸ Heinrich Kuhl, in K. H. Blume, *Enumeratio plantarum Javae et insularum adjacentium*, Lugd. Batav. 1827-8.

¹⁹ van Hasselt, collaborator with Heinrich Kuhl.

²⁰ Caspar Georg Carl Reinwardt.

²¹ Thomas Forrest, *A Voyage to New Guinea and the Mollucas . . .*, London, 1779.

²² Lesson et Garnot, *op. cit.*, p. 20: "Sumatra et Bornéo paraissent renfermer quelques espèces de quadrupèdes identiques, tels que l'éléphant des Indes, *Elephas indicus* Cuv. et les oranges".

- otang & Pongo in common.²³ Galiopithecus common to Moluccas & Pelew Is^{ds}. p. 22 New Caledonia New Ireland p. 123 & Britain same kind of dog with those of New S. Wales. |
- 18 Crocodile at New Guinea. All the isles of Oceania have the Scincus with golden streaks. — the lacerta vitteli extends to from Amboina to New Ireland. p. 23 (Voyage of Coquille Lesson)
no (p. 24) batrachian in isles of great Ocean says in conformity with Bory's^{23A} Views.
D'Orbigny^{23B} is said to have brought a tortoise & toad from S. America & identical with those from S. Africa. M. Brissou^{23C} doubts fact. — My toad is same species. |
- 23 p. 158 Cuscus albus.^{23D} New Ireland. maculatus Waigiou.
Speaking of Lepus Magellanicus says, "après un examen attentif, et forts surtout de l'opinion du baron Cuvier, nous ne balançons pas à le regarder comme une espèce distincte".^{23E} p. 171 Sus papuensis partly domesticated like in general appearance the Siamese kind. — but considered good species from dental characters, wild pig said by Forrest to swim from one is^{ld} to another.²⁴ — It is a good species. with different numbers of teats.^{24A} (Coquille Voyage) |
- 24 Durville²⁵ has written Flora of Falkland Isl^{ds}. where is it? All the Society isles have the same productions^{25A} p. 293. is very strong about this Lesson insists much. — The (p. 296) Columba Kurukuru found in all Malaisia & oceania, offers many varieties in each place to puzzle naturalists. — p. 372 Bourous the Babyroussa; a Cervus near Marianus new; & some rats & mice. In Amboina only Cuscus & Babiroussa |
- 25 N.B. (Isl^{ds} springing up more likely to have different species than those sinking. because arrival of any one plant might make condition in any one is^{ld} different). — p. 414. dogs of New Zealand of large size, resemble chien-loup. — cross, black & white, ears short & straight — do not bark.
p. 433 birds & bats have certainly travelled from East Indies Isl^d as far as Oualan. — wide space of sea. The East of America would account for this. — (Coquille Voyage) Says no reptiles p. 460 & very doubtful whether any birds Except Dodo !! — in Mauritius |
- 26 Lesson & p. 620 Centropus (coucal) of Java & Philippines has variety at Madagascar, Calcutta & Sumatra, but I do not see how it is known that they are varieties & not species. — Vol. 1. 694. Kingfisher of Europe (Alcedo ispida) from Moluccas

²³ *ibid.*, "Bornéo recèle sans doute beaucoup d'animaux inconnus; mais ceux qu'on y indique plus particulièrement, tels que l'orang-outan et le pongo, existent aussi, à ce qu'on assure, et dans la cochinchine et sur la presqu'île de malacca". Pongo is the name of the orang-utan, but it is found only in Borneo and Sumatra.

^{23A} Jean-Baptiste Bory de St Vincent, *Voyage dans les quatre principales îles des Mers d'Afrique*, Paris, 1804.

^{23B} Alcide Dessalines D'Orbigny.

^{23C} Mathurin Jacques Brisson, author of *Regnum animale*, Parisiis, 1756.

^{23D} Lesson et Garnot, *op. cit.*

^{23E} *ibid.*, p. 169.

²⁴ Thomas Forrest, *op. cit.*, p. 97.

^{24A} Lesson et Garnot, *op. cit.*, p. 175.

²⁵ Jules-Sébastien-César Dumont d'Urville, "Flore des îles Malouines", *Mémoires de la Société Linéenne de Paris*, tome 4, 1825.

^{25A} Lesson et Garnot, *op. cit.*

scarcely differs at all from those of Europe, but beak rather sharper & rather longer in proportion, colour slightly different. Who can say whether species or varieties.

27 p. 708. *Columba Oceanica* (Less.) inhabits Caroline | isld (perhaps Philippines & perhaps Friendly Isles & Hebrids) is very closely allied to *C. muscadivora*, which lives in the Eastern Moluccas. New Guinea. — (Case of replacement). Coquille Voyage. The Casuary inhabits Ceram, Borneo & especially New Guinea (replaces Emeu) in North of New Holland. —

New Guinea scarcely differs more from Australia more than Van Diemen's land —

Vol. II p. 8 no snakes on isles of central Pacific. yet there appears to be one at Botouma from account of natives, & probably on Oualan. Mitchell²⁶ says snakes on Friendly isles. p. 50 LX Journal of Silliman. Study Silliman |

28 Vol. II p. 10 it seems that crocodile was washed on shore at one of the Pellew isls — killed a woman.²⁷ Chamisso²⁸ p. 189 Tome III Kotzebue. — p. 22 a Gecko on St. Helena.^{28A} — one Gecko on Isle of France *Scincus multilineatus* (p. 45) Moluccas & New S. Wales. *Scincus cyanurus* p. 8 & p. 49 on all the Moluccas New Guinea & New Ireland & even Java & very common on Otaheite according to Quoy & Gaimard^{28B} stated in note to p. 21 in Sandwich isl^d. & according to Chamisso on Radack isl^d. —

p. 69 Shark very generally distributed: . Mem. of great geological age. Gastrobranchus only two species, one in Northern Hemisphere 2nd in southern. p. 71 *Chimera antarctica* caught Chile, Van Diemen's land & Cape of Good Hope. p. 44 of this Note Book.^{28C} also the *Taeniatole austral* |

39 ? Europe has many species but not genera distinct from rest of world ???
Lyells Principles must be abstracted & answered.

Much might be argued what is *not* cause of destruction of large quadrupeds. — common to these types of animals.

What reptiles coexisted with Palaeotherium in Paris quarries & at Binstead. Mem. recent crocodile with Palaeotherium in India — : connection with Latitudes ! ? |

40 Zoological Journal. — Vol. I p. 81 *Capromys*.²⁹ West Indian isl^d. p. 120 ref. Philosoph. Transacts 1823 (Read June 5) important paper by Dillwyn,³⁰ on replacement of Cephalopoda & Trachilidous Molluscs by each other in secondary & Tertiary periods. — p. 125 ref. to Phil. Transacts. (read November 20th) Paper by Jenner³¹ on birds seen far at sea, migrations of species. greese [geese] killed in Newfoundland with crops full of maize. (get limits of latter from Barton. — swifts return after

²⁶ *American Journal of Science and Arts*, vol. 10, no. 1, 1825, Zoology, Art. VI, letter from Dr. Samuel L. Mitchell, of New York, to Dr. Godman of Philadelphia, p. 50: "circumstantial description of a two-headed serpent I received from one of the Fejee islands".

²⁷ Lesson et Garnot, *op. cit.*, tome 2, p. 10.

²⁸ Adelbert von Chamisso, in Otto von Kotzebue, *Voyage into the South Sea*, London 1821. From the volume and page numbers that he cited, Darwin appears to have used a French edition of this work.

^{28A} Lesson et Garnot, *op. cit.*, tome 2, p. 22.

^{28B} *ibid.*, tome 2, p. 21, where Quoy and Gaimard, and Chamisso, are quoted.

^{28C} This page is still missing.

²⁹ Anselm Gaëtan Desmarests, "Abstract of a Memoir on a new genus of the order Rodentia, named *Capromys*", originally published in *Mémoires de la Société d'Histoire Naturelle*, Paris, tome 1, 1823.

³⁰ L. W. Dillwyn, "On fossil shells", originally published in *Phil. Trans. Roy. Soc.*, London vol. 113, 1823, p. 393.

³¹ Edward Jenner, "Some observations on the migration of birds", originally published in *Phil. Trans. Roy. Soc.*, London, vol. 114, 1824, p. 11.

- years to nests. Vol. II p. 49 on the localities of certain parrots habitations India & Africa.³² — N.B. Any monograph like Gould^{32A} on Trogons worth studying. — |
- 41 Zoolog. Journal Vol. 2. p. 221 Horsfield³³ on two bears *very* close species inhabiting Borneo & Sumatra, differ only in form of white mark on breast : p. 234. — good case p. 526 (ref.) to Temminck³⁴ Monograph Mammal 4^{to}, good facts about distribution of cats.
- Vol. III p. 233, states that the "Asseel Gayal (Bos Gayaeus) does not mix with the Gobbich or village Ga[y]al.³⁵ — ? is latter same species domesticated, strangely contradictory to Azaras fact of conduct of wild & tame horses. — p. 246 — Gymnura new genus of Mam. found in Sumatra.³⁶ p. 452 Append. to Denham Clapperton &c. on Mammalia³⁷ no doubt will all be included in Smiths Work^{37A} |
- 42 do. Vol. IV p. 273 Macleay³⁸ on Capromys. 4 species probably in Cuba (p. 271 Viedo^{38A} says American dogs silent. Mem. contrary assertion of Molina) (p. 277) probably another in Jamaica & perhaps one extant at Leeward Isles.
- p. 388 Reference to Rüppels Travels³⁹ (what language?)
- Hyaena venatica of Cape found in Desert of Korti & Steppes of Kordofan. p. 401. Admirable letter from Macleay to Bicheno much excellent detail & firm views about species.^{39A} — MUST BE STUDIED : genera founded in nature |
- 47 Zoolog. Transact. Vol. I, p. 165. — "an account of the MANELESS lion of Guzerat by Capt. W. Smee.^{39B} considered merely variety. — yet form of skull very slightly different. —
- Zoolog. T. V. I. p. 389 Owen⁴⁰ remarks on Entozoa. the organs of generation, afford the least certain indications of the perfection of species — ! How does this agree with grand fact of Marsupial low cerebral structure ?? — |
- 48 do. p. 390. All classes of *Acrita* exhibit lowest stages of animal organization, ["] & are analogous to the earliest conditions of the higher classes during which the changes of the ovum or embryo succeeded each other with the greatest rapidity "^{40A} — so
- ³² N. A. Vigors, "Sketches in ornithology : or observations on the leading affinities of some of the more exclusive groups of birds".
- ^{32A} John Gould, *Monograph of the Trogonidae*, London, 1835-8.
- ³³ Thomas Horsfield, "Description of the *Helarctos eurypilus* ; exhibiting the Bear from the Island of Borneo, the type of a sub-genus of *Ursus*", *Zoological Journal*, vol. 2, p. 221.
- ³⁴ Coenraad Jacob Temminck, *Monographies de mammalogie, ou descriptions de quelques genres de mammifères dont les espèces ont été observées dans les differens musées de l'Europe*, Paris & Leiden, 1827.
- ³⁵ *Zoological Journal*, vol. 3, p. 233, Thomas Hardwick, "On the Bos gour of India".
- ³⁶ Thomas Horsfield, "Notice of a new genus of Mammalia, found in Sumatra by Sir Thomas Raffles", *Zoological Journal*, vol. 3, p. 246.
- ³⁷ Major N. Denham, Captain Clapperton & the late Dr Oudney. *Narrative of Travels and Discoveries in Northern and Central Africa in the years 1822, 1823 and 1824*, London, 1826. Appendix XXI "Zoology" by J. G. Children.
- ^{37A} Andrew Smith, *Illustrations of the Zoology of South Africa*, London, 1838-49.
- ³⁸ William Sharp MacLeay, "Notes on the genus *Capromys* of Desmarest . . .", *Zoological Journal*, vol. 4, p. 273.
- ^{38A} Viedo referred to by MacLeay, *op. cit.*
- ³⁹ Wilhelm Peter Eduard Simon Rüppell, *Atlas zu der Reise in nordlichen Africa*, *ibid.*, p. 388.
- ^{39A} "A Letter to J. E. Bicheno Esq. F.R.S., in examination of his Paper 'On Systems and Methods', in the Linnean Transactions. By W. S. MacLeay Esq", *ibid.*, p. 401.
- ^{39B} Walter Smee.
- ⁴⁰ Richard Owen, "Remarks on the Entozoa, and on the structural difference existing among them : including suppositions for their distribution into other Classes", *Trans. Zool. Soc.* vol. 1, 1835, p. 387 ; on p. 389 : "With respect to generation, the organs of which function afford in their varieties the least certain indications of the relative perfection of the species".

we find species each class successively present modifications typical of succeeding classes & likewise those much higher in scale. So Owen actually believes in this view !!!!

49 p. 392. — except generation & digestion in Acrite Kingdom | all organs blended together & same organ when eliminated is often repeated. as mouths in Polypi. surely not correct view of Flustra or Ascidia. spicule in sponge. stomachs in infusoria, generation in each joint of Taenia worm.^{40B} — formative energies easily expended & no one system developed—not surprising to find many forms in Acrita. — typical of other (surely rather parents). (N.B. These views must lead to spontaneous generation ??) This whole paper must be studied. — |

50 D'Orbigny.⁴¹ Birds of prey are distributed in S. America like other forms, but those inhabiting 3^d zone of height & 3^d of latitude more commonly are the same species. instead of analogues. — in other classes this evidently relates to greater range of such forms. —

p. 56⁴² Ornithological Part of Voyage of ???⁴³ A Urubu (with one leg) attended the distribution of food at the Mission of Mojos (over 20 leagues apart from each other. — this bird was .: well-known for its impudence. This excellent case of memory without association. |

71 Mr. Gould⁴⁴ says wherever any mark like red patch on wing of Furnarius, Synallaxis &c. sure to unite the birds into group. — it is same as Yarrell's⁴⁵ remark about rock Pidgeons. — & the latter most important in obviating a great apparent difficulty — preservation of colouring, when form has changed. — Can be said that animals no notion of beauty. When does prefer most powerful buck |

72 Owen⁴⁶ talking of Plesiosaurus alludes to some structure in head which he says (evidently as an *exception*) can only be explained by direct adaptation to animals wants & not as change in typical structure ?!!

Whewell,⁴⁷ in comment few will dispute, says civilisation hereditary. i.e. instincts of wisdom like senses of savages virtue? (How come its [comes it] some convictions patriotic?) — but more especially the power of reasoning &c. &c. — |

91 Musalmans of the Peninsula, are, generally speaking a much fairer race than the Hindus in the same tracts & that in their appearance & manners they are as opposite as day & night : yet we know how remote the periods at which both left the land of their forefathers. — the first to escape the doctrine of Muhammad, the last to

^{40A} Richard Owen, *ibid.*, p. 390 ; it is indeed remarkable to find Owen supporting the theory of parallelism in embryology and the scale of beings.

^{40B} Richard Owen, *ibid.*, p. 392.

⁴¹ Alcide D'Orbigny, "Observations on the Raptores of South America, Translated from 'Voyage dans l'Amérique Méridionale'," *Magazine of Zoology and Botany*, vol. 1, 1836-7, pp. 347-359. Darwin's reference is to p. 352.

⁴² This page reference should read 36.

⁴³ *Voyage dans l'Amérique Méridionale*, . . . , . . . ; p. 36 : "La familiarité des urubus est extrême. Nous en avons vus, dans la province de Mojos, lors de distributions de viande faites aux Indiens, leur en enlever des morceaux, au moment même où ils venaient de la recevoir".

⁴⁴ John Gould ; he described *Furnarius* and *Synallaxis* in the *Zoology of the Voyage of the Beagle*, vol. 2, 1841.

⁴⁵ William Yarrell, probably personal communication.

⁴⁶ Richard Owen, "A description of a specimen of the Plesiosaurus macrocephalus, Conybeare, in the collection of Viscount Cole", [read 4 April 1838], *Trans. Roy. Geograph. Soc.*, vol. 5, 1840, p. 534.

⁴⁷ William Whewell, *The Bridgewater Treatises on the Power Wisdom and Goodness of God as manifested in the Creation*, Treatise III, London, 1836.

extend their dominion, armed alike with the Koran & the sword". quote Whewells Bridgewater Treatise (p. 26) about plants from Cape of Good Hope continuing for some time to flower at their own periods. — |

- 92 Arcana of Science & Art 1831. p. 160 account of Bulbous root from Mummy after 2000 years, germinating⁴⁸!! — Henslow doubts?

Geographical Journal Vol. V p. 201 Wellsted Memoir on isl^d of Socotra,⁴⁹ Cattle generally marked like those of the Alderney breed, but size not larger than those of Black cattle. not have hump like those from *India & Arabia* p. 202 sheep have not the enormous tails, which disfigure those of Arabia & Egypt. — Civets cats only wild animals on isl^d. — Neither Hyaenas, jackals, monkeys common to either coast

- 93 found here^{49A} not even antelopes, though common on coast of Arabia | not even antelopes though common on islets off Arabian coast. — Vol. VI. p. 89. — Lieut. Wellsted⁵⁰ "on coast of Arabia between Ras Mohammed & Jeddah". sheep numerous "of the kinds one white with a black face, & similar to those brought from Abyssinia; the others dark brown with long clotted hair resembling that of goats".

Geograph. Journal Vol. VII. p. 216. Mr. Bennett⁵¹ Voyage round world. 20 years have scarcely elapsed since the Guava introduced from Norfolk Isl^d "& it now claims all the moist & fertile land of Tahiti, in spite | of every attempt to check its increase. The woodlands for miles in extent are composed solely of this shrub". — p. 229 carcases of birds drifting out to sea —

Vol. VII p. 325 Wild dogs⁵² of Guayana always hunt in packs go all together colour reddish brown ears long. — like bull terrier. — Indian secured one as they always like to cross this breed p. 333. alludes to the Macusie breed no description given — |

- 101 A communication^{52A} to Geograph. Soc. in February or March 1838 on soil in Siberia being frozen to 400 ft in depth (& Erman's^{52B} suspicion that it is not 700) is applicable to metamorphosis theory suppose when rhinoceros lived mean temp 60° minus [?] then temp at depth of four hundred feet would be 60° + 6° (??) therefore 34° degrees of change have travelled that thickness in that period & no ways assisted by fluid currents which may take place in metamorphic action. — |

- 102 Geograph Journal vol. I p. 17 &c excellent sketch of plants of New Holland supplementary to Appendix to Flinders Voyage by Brown.^{52C} — Great space seems to

⁴⁸ *Arcana of Science & Art: or an Annual Register of useful Inventions and Improvements.* London 1831. On p. 160 "Protraction of Vegetable Life in the dry State". "Mr. Houlton produced a bulbous root which was discovered in the hands of an Egyptian mummy, in which it probably had remained for two thousand years. It germinated on exposure to the atmosphere; when placed in earth it grew with great rapidity".

⁴⁹ Lieut. R. Wellsted, "Memoir on the Island of Socotra", *Journ. Roy. Geograph. Soc.* vol. 5, 1835, pp. 129-229.

^{49A} From here to the end of the page added by Darwin in pencil after he had excised the page, to complete the sentence; hence the repetition on the next page.

⁵⁰ Lieut. R. Wellsted, "Observations on the coast of Arabia between Ras Mohammed and Jeddah", *Journ. Roy. Geograph. Soc.*, vol. 6, 1836, pp. 51-96.

⁵¹ F. D. Bennett, "Extracts from the Journal of a Voyage round the Globe in the years 1833-36", *Journ. Roy. Geogr. Soc.*, vol. 7, 1837, pp. 210-29.

⁵² R. H. Schuckburgh, "Diary of an Ascent of the River Berbice in British Guayana in 1836-7", *Journ. Roy. Geogr. Soc.*, vol. 7, 1837, pp. 302-50.

^{52A} K. E. von Baer, "On the ground ice or frozen soil of Siberia", *Journ. Roy. Geogr. Soc.*, vol. 8, 1838, p. 212; "Recent intelligence upon the frozen ground in Siberia", *ibid.*, p. 401.

^{52B} Adolph Erman, letter from, *Journ. Roy. Geograph. Soc.*, vol. 8, 1838, p. 214.

^{52C} Robert Brown, "General view of the Botany of the vicinity of the Swan River", *Journ. Roy. Geograph. Soc.*, vol. 1, 1832, p. 17.

act per se as barrier — Mem. Tartary & China, both coasts of New Holland. Compare birds of Australia with plants, with this object in view.

The intimate relation of Life with laws of chemical combination, & the universality of latter render spontaneous generation not improbable. |

- 107 Fraser⁵³ remarked to me at Zoological Society, that you never find two similar groups of birds in two countries, without intermediate ones occurring in intermediate country — i.e. mundane groups. —

Waterhouse⁵⁴ tells me in insects there are many plenty of instances of insects of one tribe taking on structure (probably accompanied by habits) of other, thus in Chalcididous insects, which I brought from Australia, *probably* live in flower & have Elytra formed from development of some other part of body. — there are hemipterous insects having spiny legs & running quick & general appearance of blattae — |
108 other Hemiptera strikingly resemble Coleoptera. —

Donacia. some orthopterous insects & some third [?] have got thighs with same peculiar structure & habits of clinging to rushes similar. — The question which I more immediately want are there Heteromera which have habits & part structure like Cuculionidae. — Are there any Crysomelidae with similar habits. But the Horae Entomologicae will tell this. —

What peculiar conditions the Staphylinidae on St. Pauls Rock must be placed under. |

- 109 Gould⁵⁵ says most subgenera confined to continent, though we have seen species of subgenera scattered over it.

We have abundant instances of remarkable structures which as far as species is concerned superabundant. Showy [?] tail in cock peacock, widow bird. Birds of Paradise, Trogons. — the one feather in wing the curious feathers in tail of Edolius. Remarkable how small detail in structure prevail amongst the same species & subgenera in families. — thus the banded tarsi is common to all the Laniadae & Muscipidae of new World, but not found in Old World. — |

- 110 If in any well developed family (Gould says)⁵⁶ there is any marked colouring of plumage (as black & white bars on wings of Trogons or lengthened rump feathers) & one species has small band & others large, then he says from long experience you may be almost sure, that there exist intermediate species. — This is remarkable & would lead one to suppose that species in same group generally contemporary. This would lead one to expect that fossil forms would generally fill up genera & not species. which is not true with shells ??? It looks as if animals perished by error. [?] |

- 111 It is most wonderful how in every family of birds, even the most strongly marked, there is a preeminently aerial, formed for flight & great *movement* in the air, & likewise rasorial species & likewise perching (Gould),⁵⁷ but the latter is obvious because all are so. —

Thus in Hawks there is a swallow, both in structure & habits (it cannot be doubted

⁵³ unidentified.

⁵⁴ George Robert Waterhouse.

⁵⁵ John Gould; cf. *Proc. Zool. Soc.*, 1834, Part II, p. 14.

⁵⁶ cf. *ibid.*, p. 25.

⁵⁷ General statements to this effect are to be found in Gould's Introduction to *The Birds of Europe*, London, 1837, and in his *Monograph of the Trogonidae*, London, 1835–8.

- that if swallow perished hawks & milvulus &c would instantly fill up their place.) — Humming bird there is strongly marked variety in the Tyrannidae. — Milvulus. —
- 112 Even flying woodpeckers, with powerful wings, but | tail stiff. — swallow & goat-sucker likewise exaggerated. — There is one most remarkable connection between these aerial representatives of the different families. — that sexes have same plumage. — this is applicable to swallow-hawk, (this not the case in swallow ??? which is most wonderful of all? whether in most aerial of swallow) Milvulus. & still more wonderfully to the Humming bird, which is one instance of its whole family where female is not dull. — I must observe that this pre-eminent structure is not always applicable to same habits, though swallow hawk milvulus may catch insects on the
- 113 wing & pratancola (? connected | with Chionis), yet the Tropic bird, has very different habits, though pre-eminently belonging to this type. ?Humming bird? the woodpecker Gould says he believes does but also on fruit. —

- The Rasorial type is wonderfully shown in the long legged cuckoos with claw like lark (one in Australia is called swamp pheasant) goatsucker, parrots with claw like lark (N.B. The La jeune veuve parrot though so much on the ground has not this
- 114 structure, instance of habit going before structure.) — | even one Kingfisher Gould has seen with long tarsi. — ground woodpecker Secretary bird. — & Mellisuga Kingii very rasorial for type. — Now here I must observe these characters vary in degree in last instance hardly at all developed. not confined to one species, but generally small genus ? are there not many ground parrots ? are there not many ground woodpeckers ? —

In each division Gould thinks he can trace structure for insects & structure for vegetation. — |

- 115 In conservation in Museum I could not discover any other clear relations besides aerial, & terrestrial — How is it in water birds. — there are walking forms in water birds. — but no web forms in land birds. — Groups of very different value have their representatives, the rasorial may be observed even in Lessonia &c. &c.

In relations of affinity all organs change together, in analogy certain parts perfect of typical structure certain parts changed |

- 116 Has S. Africa & Australia, & S. America very few forms in common, but each several with Europe & northern Asia, & Northern America. — may we not look at these Northern regions as the receptacles of the wanderers out of the rest of the world? — Will this not agree with Waterhouse⁵⁸ & mammalia. — We have clear indication |

- 141 have elapsed. — let these families take domestic animals with them they might be supposed to change & make genera of birds analogous. animals would be possessed by the different races of man, yet altogether different. — To make this case perfect, we must suppose men instead of mere colour & trifling form & lead on to become greatly changed in structure & even to certain degree in habits, yet we may have there analogies. — We must try [?] races of such men living in same country but
- 142 separated, now | if one or the other race had become eminently aquatic, (N.B. aquatic i.e. relation to element & not minding particular trades.) — then the second

⁵⁸ George Robert Waterhouse contributed the section on Mammalia in the *Zoology of the Voyage of the Beagle*, London, 1839, i.e., published after this note was written by Darwin.

race would not obtain a cast of washing men, but might have the preexisting race, thus the analogy would not in all cases be produced. but would depend on exclusion. —

The same characters which are analogical in a genus with respect to rest of its family as in ground cuckoos, is affinity with respect to species of each other, because we suppose all descended from same. — but if two original species, each became ground, then the relation of all the ground cuckoos would not be affinity, but the truth would never be discovered. |

147 The *quantity of life* on planet at different periods depends on relations of desert, open ocean, &c. This probably on long average equal quantity, 2° on relation of heat & cold, therefore probably fewer now than formerly. The *number of forms depends* on the external relations (a fixed quantity) & on subdivision of stations & diversity, this perhaps on long average equal. |

148 The Cocos & Mar on the Mahé islands, on the higher parts & only on those & the islets separated at high water, not other islands, nor on any other part of world, no other plants peculiar to these isl^{ds}. Can not bear the least salt water. Nuts prodigiously heavy (when trees of such nature far apart, must have travelled by each tree dying & mountain torrents, but to crawl up an hill. thereby deaths !!) looks like subsidence on the islets |

161 examine structure of this bird & get account of habits.

My definition of species has nothing to do with hybridity, is simply, an instinctive impulse to keep separate. which no doubt be overcome, but until it is these animals are distinct species.

If any one is staggered at feathers & scales passing into each other let him look at wings & orbits of Penguin & then he will cease to doubt : Scales into Teeth in Bony Pike (Waterhouse) |

162 It would be curious to know whether variety could be transmitted more easily in those born without coitus, than with. Magazine of Zool. & Bot. Vol. II p. — Dr Johnston⁵⁹ on Entomostraca Daphnia produce young, capable of producing young many times & lay two sorts of eggs. one remaining through winter. Might be given as a hopeless difficulty, except as distinct creation. — Generation may be viewed as condensor. Must (on my theory) — supported by foetal lower developed forms. — (N.B. Waterhouse says of *affinity* of many insects may be told by their larvae) but the acts of condensing must alter method of generation. — Heaven knows how. — This reaction takes place in every organ. Hence method of generation is very good general character in those animals where much change has been added, as it speaks to amount of change only & not kind : insects, vertebrata — plants. at first classification on generation might appear convention |

183 Erasmus⁶⁰ says he has seen old stallion tempted to cover old mare by being shown young one. —

Many African monkeys in Fernando Po — no new *forms* only species!

No salamanders (D'Orbigny Rapport p. 11) in S. America so highly developed

⁵⁹ W. Baird, "The natural history of the British Entomostraca", *Magazine of Zoology and Botany*, vol. 2, 1837-8 ; on p. 406 : "it is ascertained that one single copulation is sufficient not only to fecundate the mother for her life, but all the female descendants for several successive generations". The reference to Johnston's is obscure.

⁶⁰ Erasmus Alvey Darwin, Darwin's elder brother.

in North.⁶¹ — Ichthology of S. America more peculiar than its ornithology p. 12 do. excepting salmons.

L'Institut Sorex from Mauritius⁶² p. 112 ; & paper on genus. |

184 Magazine of Zool. & Bot. Vol. I, p. 456 4 instances of hybrids between pheasant & Black fowl.⁶³ — use as argument possibly some few hybrids in nature. —

p. 473 Webb & Berthelot⁶⁴ must be studied on Canary islands.^{64A} Endeavour to find out whether African forms (anyhow not Australian) on Peak. Did Creator make all new, yet forms like neighbouring continent.

Chapter ten translated by Hooker. — my theory explains this but no other will. St Helena (& flora of Galapagos ?) same condition Keeling Isld. shows when proper dampness seeds arise quick enough. Vegetation of Peak altogether original⁶⁵ owing to being oldest & having undergone change ? ? no near lofty country p. 475. N.B. This bears on fossils of Europe, those species which can migrate remaining constant in form, others altered much. these others will be plants & land animals & land shells — all in short. Extreme North = to peak of Tejde in relation to surrounding countries & present tropical count[ries] . . .

185 p. 564 an abstract of Mr. Swainsons⁶⁶ views which if abstract true are *wonderfully* absurd. —

p. 565 Scotch wild Cattle breed freely with the tame.⁶⁷ Vol. II Magazine of Zoology p. 56 Peregrine Falcon holds *birds* for some time alive ? therefore other species mice & only kills them when urged by hunger.⁶⁸ —

p. 65. Aberrant groups⁶⁹ few in numbers & vary much in character, divided into many small genera : circumstances not favourable to many species. same circumstances which by causing death makes the group aberrant |

186 When species rare we infer extermination when group few in number of kind. extermination. — New forms *made* through probably an infinite number of forms. — therefore an isolated form probably a remnant. — Pachydermata & Horses few forms & they are remnants. — Cephalopoda ditto. —

Mag. of Zool. & Bot. Vol. II p. 125. Allusion to abortive spiracles in Hemiptera.⁷⁰

⁶¹ Alcide D'Orbigny, *Voyage dans l'Amérique méridionale*,

⁶² L'Institut, avril 1838, p. 112, "Le *Sorex sonneratii* . . . deux exemplaires recueillis par les frères Verreaux dont l'un provient de Java et l'autre de l'île Maurice".

⁶³ William Thompson, "On hybrids produced in a wild state between the Black-Grouse (*Tetrao tetrix*) and common Pheasant (*Phasianus colchicus*)", *Magazine of Zoology and Botany*, vol. 1, 1837, p. 450.

⁶⁴ P. Barker Webb & S. Berthelot, *Magazine of Zoology and Botany*, vol. 1, 1837, p. 473 : "Aspect général de la végétation des îles Canaries" has been already well translated in Dr Hooker's Botanical Miscellany".

^{64A} P. Barker-Webb & S. Berthelot, *Histoire naturelle des Îles Canaries*, Paris 1836.

⁶⁵ *Magazine of Zoology and Botany*, vol. 1, 1837, "Reviews and critical analysis (*Histoire naturelle des Îles Canaries*)", p. 475 : "The Peak itself, the 'Teyda', the vegetation of these wild regions is found to be altogether original".

⁶⁶ *Magazine of Zoology and Botany*, vol. 1, 1837, pp. 545-66, "Dr Lardner's Cabinet Cyclopaedia. Natural History, 1. On the Geography and Classification of Animals. By W. S. Swainson".

⁶⁷ *ibid.*, p. 565, "We know, beside, that they breed freely with the common ox, and that the progeny produced from the cows is also productive".

⁶⁸ William Thompson, "Contributions to the Natural History of Ireland", *Magazine of Zoology and Botany*, vol. 2, 1837-8, pp. 42-57 ; on p. 53 : "still retaining its first victim, secured the second with its other foot, and bore both off together".

⁶⁹ G. Johnston, "Miscellanea Zoologica", *Magazine of Zoology and Botany*, vol. 2, 1837-8, pp. 63-73.

⁷⁰ John Obadiah Westwood, "Notes upon Sub-aquatic Insects, with the description of a new Genus of British Staphylinidae", *Magazine of Zoology and Botany*, vol. 2, 1837-8, pp. 124-132.

do. p. 160. Soft plumage of night jar like owls.⁷¹ analogy in habits adaptation to nocturnal habits — to cats &c. — must be acquired by my theory else my theory not applicable |

- 205 L'Institut 1838 p. 128 Extraordinary genus Mesites bird from Madagascar uniting pigeons & gallinaceous birds & parrots.⁷² — legs of pigeon perfect. — &c. &c. do. p. 136 Ichthyosaurus in the Chalk.⁷³

Those who say philosophically to a certain extent, nothing but experience will tell us when group is true, — there are no genera if mammalia are adduced, say oh look to your fossils, now if extinction had gone, without creation this would have been fair, but to place all that ever have lived into one list is unfair (moreover what will become of the future creations, if the list is now perfect. —) the creator so creates animals, it will be said, that although at any one there are gaps yet altogether he has created a perfect chain *** supra on next page |

- 206 It is a fact pregnant with SOMETHING? that intermediate species have generally perfect organs of two adjoining families & not *all* organs blending away. — do changes of habits affect particular organs. —

***Hopeless work to systematist, who believed that all his divisions merely marked his own ignorance. The collector was plodding at making a series, which would render our knowledge a chaos : who will doubt this if series now existed from man to monad — though physiology would profit if the series were believed to pass into each other. —

Different classes keep to their types with different degrees of closeness — look how close birds ! look at Mammals. how wide. — therefore birds younger ???! or have not been exposed to so many contingencies ??? |

- 209 some of the Ostriches were to die, then they would appear isolated.

In my birds from S. Hemisphere there are some godwits which are close to European species. and the sexes of which vary in colour of plumage in same remarkable manner as European species = singular coincidence if distinct creation. — i.e. — a mere statement nothing is explained. — this is fact analogous to mocking thrush of Galapagos having tone of voice like S. American. —

Have not Ruffs & Reeves a remarkably varying plumage for wild birds — |

- 210 At Zoolog. Garden there is half Jackal & Scotch Terrier — certainly more like Jackal in *gait*, size, fur ; manner in which ears droop like dog in character, & manner of wagging tail habitual movement connected with mood. —

There is no progression in the development in instincts in the orders of insects, so is there none of reason in orders of mammals. — Mem. Elephants & dog. There is one living spirit prevalent over this world. (subject to certain contingencies of organic matter & chiefly heat), which assumes a multitude of forms each having acting principle according to subordinate laws. — There is one thinking sensible principle (intimately allied to one kind of |

⁷¹ W. B. Clarke, " Observations on *Caprimulgus europaeus* (night-jar) ", *Magazine of Zoology and Botany*, vol. 2, 1837-8, pp. 158-63.

⁷² M. Bernier, *L'Institut*, tome 6, 1838, p. 128 : " [Mesites] analogue par ses pattes au Pigeon plus qu'à aucun autre group. par ses ailes à la plupart des vrais Gallinacés ".

⁷³ A. Courcier, *L'Institut*, tome 6, 1838, p. 136 : " Présence de l'Ichthyosaure dans la craie ".

- 213 Major Mitchell⁷⁴ is not aware that Australian dogs ever hunt in company — marked difference with dogs of La Plata & Guyana — people will say not species. —

Organs of generation a capital character (Owen)⁷⁵ not for first & grandest division. but for one of very high order. not for vertebrata. but mammalia & reptiles &c.

Timor is connected with Australia — Map to King's⁷⁶ Australia — by a bank of soundings of which there appears to be one line in which greatest depth is not more than 60 F. & in the whole area 120 is greatest (about 200 miles distant). — directly beyond produced line of Timor 213. What productions Sandal Wood Isl^d.? ought to agree with Java ?? |

- 214 Terrestrial Planariae assuming bright colours; good instance of colours dependent on localities. —

Hamilton will give an account in his Travels in Asia Minor of the domestic animals. At Angora Centre of Asia Minor are the fine haired goats, which it is said cannot be transported from their country. — the long-haired cats are supposed to come from there. — All the sheep are thick-tailed. The dogs called Persian greyhounds are Kurdish & come also from Asia Minor. — tail like setters. long ears — colours vary, but form constant. — |

- 215 These abortive organs in some males animals, mammae in man, capable of giving milk.

The females of some moths, like glowworm have rudimentary wings so nature can produce in sex what she does in species of Apteryx.

This is important because if these abortive wings in the female are allowed to the fully organized wings of the male rendered abortive in the womb — if these apparently useless organs do indicate such origin, then we are bound to consider abortive organs of same tendency in species. this is capital & novel argument. — (there is paper by Yarrell⁷⁷ in Zoolog. Transactions & Hunter⁷⁸ on this subject). Are there any abortive organs in neuter bee, because if so as she can be converted into female, it will be splendid argument. Old female turning into cocks. abortive spurs growing. — |

- 216 Are there any abortive organs produced in domesticated animals. in plants I presume there are? get examples. — for instance where a tendril passes into a mere stump. — Shall abortive organs of very same kind in these cases, have plain meaning and none in other case!

Savigny⁷⁹ has shown same fundamental organs even in Haustellata & mandibulata. — !! Argument where general argument is extended from species to genera & classes.

p. 479. fragment of tusk & molar tooth of Hippopotamus from Madagascar⁸⁰ !!!!!
Proceedings of Geolog. Soc. Vol. I.

⁷⁴ Thomas Livingstone Mitchell, *Three expeditions into the Interior of Eastern Australia*, London, 1838.

⁷⁵ Richard Owen, "Remarks on the Entozoa", *Trans. Zool. Soc.* vol. 1, 1835, p. 387.

⁷⁶ Philip Parker King, *Survey of the Intertropical and West Coasts of Australia*, London, 1818–22.

⁷⁷ William Yarrell. Reference untraced.

⁷⁸ John Hunter, *Observations on certain parts of the Animal Oeconomy*, with notes by Richard Owen, London, 1837, pp. 422–66: "Observations on Bees".

⁷⁹ Marie-Jules-César de Savigny, ? *Mémoires sur les animaux sans vertèbres*, Paris, 1816.

⁸⁰ *Proc. Geol. Soc.*, vol. 1, 1833, p. 479, "A letter was afterwards read from Mr Telfair to Sir Alexander Johnson, accompanying a specimen of recent conglomerate rock from the island of Madagascar, containing fragments of a tusk and part of a molar tooth of a hippopotamus".

It is capable of demonstration that all animals have never at any one time formed chain, since if cretaceous period assumed, then some perished before. carboniferous some perished |

- 221 male glow worm knowing female good case of instinct. bees turning neuter into Queen. more wonderful case.

Dwight's⁸¹ Travels in America, speaks of short-legged sheep, hereditary proceeding from an accident. New England farmer — useful could not leap fences : — Dr Lang⁸² (quoted) on Polynesian nation p. 4. — do. p. 186 quote Burkhardt⁸³ to show black colour of certain Arabs. — N.B. avoid quoting these hackneyed cases. |

- 222 Mr. Edw. Blyth⁸⁴ does not believe in circular or linear arrangement. — Thinks passage very rare, in anatomical structure. — the passage between owls & hawks only external. intermediate groups often have full structure of one class & full of second — this class if analogous to petrel-grebe external appears to be a puzzle against my theory. —

If I be asked by what power the creator has added thought to so many animals of different types, I will confess my profound ignorance. — but seeing such passions acquired |

- 225 element of extreme difficulty in mundane geological chronology.

Annals of Natural History Vol. I ?? p. 318 some remarks on Bonaparte's⁸⁵ list of birds in Europe & N. America on closely allied species replacing each other. good to consult.

p. 326 wild ass extending over 90° of Long. & Col. Sykes⁸⁶ alludes to some other case of 180° & great diff. of Lat^d.

p. 355. Echidna of Van Diemen's land & Australia different.⁸⁷ Temminck Fauna Japonica (??) 82 Mammalia⁸⁸

p. 293 Phalangista⁸⁹ of Australia & Van Diemen's land diff. — |

⁸¹ Timothy Dwight, *Travels in New England and New York*, London, 1823.

⁸² John Dunmore Lang, *Origin and migrations of the Polynesian nation*, London, 1834.

⁸³ John Lewis Burkhardt, *Travels in Arabia*, London, 1829.

⁸⁴ Edward Blyth, "Observations on the various seasonal and other external changes which regularly take place in Birds, more particularly in those which occur in Britain; with Remarks on their great Importance in indicating the true Affinities of Species; and upon the Natural System of Arrangement", *Magazine of Natural History*, vol. 9, 1836 pp. 393-409; on p. 407: "[referring to those who] hold that every natural assemblage of species, great or small, forms part of some quinary circle. Now, I cannot but observe here . . . I should think that a due consideration of this first *binary* distribution must at once carry conviction of the mind, must be at once a most unanswerable argument against all quinary or similar doctrines . . ."

⁸⁵ Charles Louis Bonaparte, Prince of Musignano, "A geographical and comparative list of Birds of Europe and North America", *Annals of Natural History*, vol. 1, 1838, pp. 318-320.

⁸⁶ *Annals of Natural History*, vol. 1, 1838, p. 322, "Proceedings of Learned Societies . . . A Paper was read by Colonel Sykes, 'On the identity of the Wild Ass of Cutch and the Indus, with the Dzegettai (Equus hemionus of Pallas)'."

⁸⁷ *Annals of Natural History*, vol. 1, 1838, p. 335: "Miscellaneous". . . . On the two species of Echidna, by J. E. Gray. "Sir E. Home, in his paper in the *Phil. Trans.* for 1802, figured two specimens of this animal, and Cuvier (*Règne Animal*, vol. 1, p. 225) considered them as two species, naming the one *Echidna Hystrix*, and the other *E. setosa*; but most succeeding zoologists have regarded them as a single species . . . The *E. Hystrix*, Cuv. . . . came from the continent of New Holland, while *E. setosa*, Cuv. . . . is confined to Van Diemen's Land".

⁸⁸ *Annals of Natural History*, vol. 1, 1838, p. 335: "Miscellaneous" . . . "Zoology of Java". "Temminck, in the *Fauna Japonica*, states, that he knows 82 kinds of mammalia, 455 birds, and 90 species of amphibia, as inhabiting that Island, although the interior is almost entirely unknown".

⁸⁹ John Edward Gray, "A reply to Mr Ogilby's Communication to the *Annals of Natural History* respecting *Phalangista cookii*", *Annals of Natural History*, vol. 1, 1838, pp. 293-7.

226 Habits can only be used in classification as indication of structure (including brains & other organs difficult to analyse). will not this separate facts about abortive organs &c.

The doctrine of monsters⁹⁰ is preeminently worthy of study on the idea of those parts being most easily mortified which last produced — insane men in civilized countries — this is well worthy of investigation. |

227 Institut 1838 p. 174. Aperçu very good on insectivorous quadrupeds — geographical range very good. — Blainville⁹¹

Ovington's⁹² voyage to Surat floating isl^d off coast of Africa p. 69 with tall grass. p. 72 hairy sheep —

Edinburgh Transact Vol. IX p. 107 An Ascaris inhabits the eyes of horses in India in which it may be seen swimming about.⁹³

A. Smith⁹⁴ is firmly believed in representation. certain birds in many families, & very often in number 55 will have long tail. — in raptorial birds, & tigers & sharks, being spotted & colours of little value |

228 Dr Smith⁹⁵ if black & white man crosses, children heterogenous, he feels sure of this, first offspring most like mother. — like dogs Smith knew chinese hairless dog & common spaniel crossed. — 3 puppies *perfectly* like chinese & 3 perfectly like spaniel even when grown up. — Are mules homogenous owing to no attempt to keep up offspring, are not half lion & tigers ditto. (see Griffith)⁹⁶ & half Muscovy ducks, black cock & pheasant see Jardine's Journal.⁹⁷ — consult on this point — pigs always go against this, without number of vertebra new acquisition, we must |

237 ∴ Those animals, which only propagate by scission can not alter much ? !

Mr. Brown showed me Bauer's⁹⁸ drawings of a curious plant where a tube consisting of pistils & stamens united into long organ, moved on being touched, so as to protect itself, one segment of the corolla being (probably) smaller to allow it to lie on one side. — but in other species, this segment is converted into hood which possesses
238 power of movement & not the organ itself | How except by direct adaptation has such a change been effected. — the consciousness of the plant that this part must be protected however it may be effected. —

Prodromus Florae Norfolkicae. 1833 Steph. Endlicher⁹⁹ (He will give sketch of

⁹⁰ John Hunter, in Richard Owen, *Descriptive and illustrated Catalogue of the Physiological Series of Comparative Anatomy contained in the Museum of the Royal College of Surgeons in London*, London, 1833, vol. 1, p. iv.

⁹¹ Henri-Marie de Blainville, *L'Institut*, tome 6, 1838, p. 174, Zoologie : Mammifères Insectivores.

⁹² John Ovington, *Voyage to Surat* 1689, London, 1696.

⁹³ Alexander Kennedy, "Account of a non-descript Worm (the Ascaris pellucidus) found in the eyes of Horses in India", *Trans. Roy. Soc. Edinburgh*, vol. 9, 1823, p. 107.

⁹⁴ Andrew Smith, possibly personal communication.

⁹⁵ ditto ; cf. also Edward Blyth, "An attempt to classify the varieties of animals", *Magazine of Natural History*, vol. 8, 1835, pp. 40–53 ; on p. 52 : "The mixed offspring of different varieties of Man thus generally blends the character of each, though instances are not wanting of its entirely resembling . . . either one or the other of its parents".

⁹⁶ Edward Griffith, *The Animal Kingdom arranged in conformity with its organization, by the Baron Cuvier . . . with additional descriptions of all the species*, London, 1827.

⁹⁷ William Thompson, "On the hybrids produced in a Wild State between the Black-Grouse (*Tetrao tetrix*) and the Common Pheasant (*Phasianus colchicus*)", *Magazine of Zoology and Botany*, vol. 1, 1837, p. 450.

⁹⁸ Ferdinand Bauer, in Matthew Flinders, *A Voyage to Terra Australis*, London, 1814, vol. 2.

⁹⁹ Stephan Ladislaus Endlicher, *Prodromus Florae Norfolkicae ; sive catalogus stirpium quae in insula Norfolk annis 1805–5 a Ferdinando Bauer collectae . . . Vindobonae*, 1833.

botany of islands of south sea says so in preface. — Mr. Brown¹⁰⁰ says character of Flora N. Zealand & N. Caledonia with a dash of New Holland. same species as in
 239 N. Zealand — Some species of Australian Genera | same (Palm & *&hormium tenax*) as in New Zealand & Australia. some SPECIES of AUSTRALIAN GENERA .'. good case. rather large flora (150 ?)

Mr. Brown did not observe scarcely any Australian character in Timor plants, yet it seems there may be Eucalyptus! — (Hostile fact)

Be cautious about Goulds¹⁰¹ case of birds of Van Diemens land & Australia. — The wombat (Brown)¹⁰² is found in Is^d of Bass's Straits |

240 The common mushroom & other cryptogamic plants same in Australia & Europe.¹⁰³ — if creation be absolute theory, the creation must take place as when creator sees the means of transport fail. — otherwise no relation between means of transport & creation exists. — pool may have been created at many spots & since disseminated.

See Habits of Malay fowls¹⁰⁴ p. 5 (note) on some papers on instincts¹⁰⁵ |

241 L'Institut 1838 p. 184 Botany of Bonin¹⁰⁶ "grande analogie avec la Flore du Japon", some European & Sandwich species & some of Japan. I do not understand any new ones. — Memoir will be published St. Petersbrough Academy Imperial. Paper read in 1837 semestre..

I suspect some valuable analogies might be drawn between habitual actions of plants when exciting cause is absent & memory of animals. — (surely in plants |
 242 movements effects of irritability, though means injection of fluid different from contraction of fibre) — it is most remarkable habitual action in plants, it allows of any degree in lowest animals habitual action in intestines subject to sympathetic nerves —

The vividness of first memory in children or rather their memory. very remarkable — scenes in themselves accidental — my first thought of sea side — |

249 N.B. I met an old man who told me that the mules between canary birds & goldfinches differed considerably in their colour & appearance. Every now & then — short-tailed *cat* ?cut? has its offspring short tails/one born at Maer

Tuckeys Voyage¹⁰⁷ p. 36 "*Cercopithecus sabaeus*" said to be monkey of St Jago C de Verds; same as on coast of Africa. — Macleay tells me same thing. p. 55. 40 leagues from land several patches of reeds & trees.¹⁰⁸ p. 259. 120 ft in length.

¹⁰⁰ Robert Brown, in Matthew Flinders, *A Voyage to Terra Australis*, London, 1814, Appendix III; possibly also personal communication.

¹⁰¹ John Gould, *Synopsis of the Birds of Australia and the adjacent islands*, London, 1837–8.

¹⁰² *Proc. Zool. Soc.* 1836, p. 49, the wombat "was brought from one of the islands in Bass's Straits".

¹⁰³ Robert Brown, in Matthew Flinders, *Voyage to Terra Australis*, London, 1814, Appendix III, p. 539: "southern extremity of Van Diemen's Island, where the necessary conditions exist, the relative proportion of Cryptogamous plants is not materially different from that of the south of Europe".

¹⁰⁴ reference untraced.

¹⁰⁵ John Oliver French, "An inquiry respecting the true nature of instinct, . . ." *Zoological Journal*, vol. 1, 1825, pp. 1–3, 153–173, 346–366.

¹⁰⁶ Heinrich Gustav Bongard, *L'Institut*, tome 6, 1838, p. 184, "Mémoire sur la végétation des Iles de Bonin"; original in *Bull. Scient. Acad. Imp. Sci. Saint-Petersbourg*, tome 2, 1838, pp. 369–372.

¹⁰⁷ James Kingston Tuckey, *Narrative of an Expedition to explore the River Zaire, usually called the Congo* 1816 . . . , London, 1818.

¹⁰⁸ *ibid.*, p. 55, "When forty leagues from the land, several floating patches of reeds and trees passed us".

some branches of *Justicia* still growing passed us.¹⁰⁹ |

- 250 do. p. 243 (Professor Smith's Journal) on the heights of St. Jago found a *Euphorbia* so near *Piscatoria* as scarcely to be distinguished from it.¹¹⁰ — & several old acquaintances which grow on the lower region of the Canary islands. — p. 250 admirable table of plants of St. Jago showing many common to Canary isl^d, Europe, & St. Jago upper region, & some to Cape. — some proper well worth studying, with
251 respect to forms. — | Study Appendix¹¹¹ to Tuckey's Expedition

Journal of the Academy of Natural Sciences of Philadelphia Vol. VII Part II 1837 accounts of the various hares some since discovered of N. America,¹¹² & of the shrews.

- Dr Bachman¹¹³ told me that near Charleston ? three species near New York (600 miles N. ?) replaced by three other species. — Says all the hares West of Rocky Mountains have peculiar character in extreme length of ears & length of limbs, so
252 that he first thought only one species. & all hares on East side have other | peculiar appearances. Now this is precisely the case with the mice of S. America with respect to the Cordillera. — Bachman has seen webbed shrew. case of adaptation. — (case of Squirrel from extreme north turning white like Hares ?) I never saw more beautiful adaptation for snow like snow shoes than feet & hind legs of these white hares, fitted for region of snow. — |

- 257 In Holme's History of Man at Maer,¹¹⁴ it is said the Samoyed women (?North end of the Oural mountains) have black nipples to their breasts. —

L'Institut, 1838, p. 230 says the *Macrotherium* of Europe is between the anteater of Good Hope & those of S. America.¹¹⁵ — Are not some of the Australian fossils intermediate between those of Van Diemen's land & Australia proper. — Irish Elk case of fossil geographical range. |

- 258 [blank]

¹⁰⁹ *ibid.*, p. 259, "120 feet in length and consisting of reeds resembling the *Donax*, and a species of *Agrostis*, among which were still growing some branches of *Justicia*". These notes show that Darwin was already concerned with the survival of land organisms in sea water.

¹¹⁰ *ibid.*, p. 243, "I found at last an *Euphorbia*, that bore so near a resemblance to *piscatoria* as scarcely to be distinguished from it".

¹¹¹ *ibid.* Appendix V, p. 420, is by Robert Brown, "Observations, Systematical and Geographical on Professor Christian Smith's Collection of Plants from the Vicinity of the River Congo."

¹¹² John Bachman, "Observations on the different species of Hares (genus *Lepus*) inhabiting the United States and Canada", *Journ. Acad. Nat. Sci. Philadelphia*, vol. 7, 1837, p. 282.

¹¹³ *ibid.*, p. 358; also personal communication.

¹¹⁴ Henry Holme, Lord Kames, *Sketches of the History of Man*, London, 1774.

¹¹⁵ Henri-Marie de Blainville, "Dépôt d'ossements fossiles de Sanson", *L'Institut*, tome 6, 1838, p. 230: "*Macrotherium*, qui démontre en Europe l'existence d'un genre intermédiaire au Pangoline et à l'*Orycteryx* d'Afrique et aux Fourmiliers d'Amérique".

Pages excised from Third Notebook

III

- 5 W. D. Fox¹ has a cat which he bought in Portsmouth, said to come from coast of Guinea, — ears bare, skin black & wrinkled — fur short (tail cut off in progeny peculiar) limbs very long, eyes very large, very fierce to dogs. — otherwise habits not different; tone of voice perhaps rather different. Crossed with common cat, exact variety unknown, three kittens alike each other, partaking very closely of form of mother: more than of the common cat. — ([in pencil:] Ch IX Mongrels Hybrids)
Fox has *half* Persian cat which bred with unknown common house cat. — had four
6 kittens. two appeared | so very like common cat, that they were killed & other two very closely resembled in form of tail, fur &c. to the half bred Persian. — Here then we have clear case of heterogenous offspring from one impregnation. ?is this one impregnation, or two impregnations one giving half character & other more of English, but the effect is the same. —

- 7 Fox thinks that when a *wild* animal is crossed with a | tame, offspring always takes most after wild. — i.e. that no domesticated ones have been so long as wild one under present form. — Fox has seen several cases of foxes and dogs crossed. offspring always more resembled foxes than dogs (mem Jackal in Zoolog. Gardens) He has seen in a show half wolf & half Esquimaux dog which appeared to be intermediate between two parents. — this is very interesting as Esquimaux dog approaches to species. Again he has seen several crosses between Esquimaux dog & common
8 dogs & Fox thinks they decidedly take | much more after Esquimaux. — this agrees perfectly with Yarrell² & no leading question was put. —
Fox thinks half Lion & Tigers are exactly intermediate in character & kittens alike each other. —

Even in children of parents one sometimes resembles one parent & one another & are not exactly intermediate. — |

- 11 & another leader mare. — this stallion though eager to all other mares had been entirely broken from these mares, (though horsing every month) & worked in the same cart in loose chains, by being at first beaten from her, & always accustomed to her. — even parallel to brothers & sisters in mankind. —

The case of all blue eyed cats (Fox has seen repeated cases) being deaf curious case of corelation of imperfect structure. — |

- 12 Fox says in Lord Exeter's Park or in the Duke of Marlborough there is a breed of white-tailed squirrels, which form a marked *wild* variety. doubtful whether all are white. Fox says half Muscovy.

Fox says a settler near Swan river lost his two cows entirely, changed his residence a great many miles — yet one day a cow walked in, then disappeared, & three days afterwards came again, bringing with her the other & younger cow. — |

- 29 Mr. Blyth³ remarked that greater difference in the 4 Struthionidae, than in many large orders of birds. The Emu & Cassowary closest. — Ostrich & Rhea closest. —

¹ William Darwin Fox, personal communication.

² William Yarrell; this and the following pages read like notes taken at a discussion meeting of the Zoological Society.

³ Edward Blyth.

(& 2 Rheas still closer). — Mr. Blyth asked whether structure of pelvis &c was not adaptive structure, like little wings of Auk which does not make that bird a Penguin. — (i.e. whether relation in one point or many) Owen⁴ answered that all characters might be considered as adaptative and that he did not see where the line could be drawn. — thus the most remarkable character in Apteryx, small respiratory system ;
 30 even much smaller | than in other Struthios was adaption to little movement. — nocturnal crawling bird. — Wings reduced to rudiment. — clavicle scapula &c. strongly developed to aid in breathing. —

Animals from Hobart Town mentioned, it seems most of species from there now found in Australia. —

New species of Moschus characterized by Ogilby.⁵ who observed that the young of this animal which is so anomalous among true deer yet is spotted like so many deer. — very curious like some facts of Mr. Blyth on birds. — |

31 Dr Bachman⁶ tells me line of Rocky Mountains separates almost all Mammals of N. America & many birds, which however are most closely represented. — Thus the red breasted thrush is separated by one not differing except by black line. — A Bunting by one only differing by some permanent white streaks. — &c. &c.

Dr Bachman has crossed cock Guinea Fowl with Pea Hen. — offspring female,
 32 yet so infertile never even in seven years produced even an egg. — | a most curious bird, did not seem to know itself, at last associated with the ducks. — most *strange voice* often in the night, like peacock. — tail as long as Pea hen. — about intermediate. — (In Zoolog. Garden there is hybrid of Penguin duck a variety of Muscovy with goose !!)

Dr Bachman regularly breeds in Carolina for his table Muscovy & common ducks — they are produced in full equal numbers with pure bred (just like common mules)
 33 & lay many eggs but never produce inter se or with | parent species. — The hybrids do not vary (i.e. the hens all alike & cocks all alike) more than parent species. — Mr. Blyth remarked only near species or varieties produce heterogenous offsprings. — are not the hybrid pheasant & grouse different — (if so chinese pigs & common must be considered as distant species ?? or is time the varying element). Then do those *species* which breed most freely & produce somewhat fertile offspring produce heterogenous offspring.

It appears certain that hybrid Muscovy & common duck have been shot wild (escaped from Carolina)? off New York. therefore instincts not imperfect. Are Pheasant & Grouse homogenous? |

34 I observe Bachman calls these *Hybrids new species*.

Yarrell says the bird fanciers say the throw of any two species crossed is uncertain.

Yarrell remarks he has somewhere met conjecture that all salt-water [recte fresh water] fish were once salt water (as they almost must have been on elevation of continents) but Ogilby well answers that nearly all F.W. Fish are Abdominals .∴ that order first converted. — is it an old order geologically? |

⁴ Richard Owen.

⁵ William Ogilby.

⁶ Rev. John Bachman.

53 will come from common stock. — all genera common stock — so that values can only be judged if in each separate line of descent. — & here limits of varieties being constant it would be exceedingly wrong to call one group genus & other subgenus. — Propagation best rule for genera, & so mount upwards, judged by analogy. — Consider all this.

N.B. How can local species as in Galapagos, be distinguished from temporal species as in two formations? by no way: — |

54 "Natura nihil agit frustra" as Sir Thomas Browne⁷ says "is the only indisputable axiom in Philosophy Religio Medici Vol. II Sir T. Browne's works p. 20.

"There are no grotesques in nature; not anything framed to fill up empty contours, & unnecessary spaces" p. 23 "for Nature is the act of God" — after Decandolles idea

Septemb 1. It has been argued man first civilized add this in note. ?mere conjecture? — Australians. — Americans &c. |

55 Septemb. 1. Macleay⁸ & Broderip⁹ when talking of some Crustacean, like Trilobite (Polirus??) female blind & quite different form from male with eyes! — (are not these differences in sex confined to annulosa?) remarked that young of Cirrhipedes can move & see, parents fixed, — young of sponges move. — young of Cochineal insects move about & see, parent female fixed & blind: — Macleay observed all these *facts* proves that *perfection* of organs have nothing to do with *perfection* of individual, though such relation seems common, but the perfection consists in being able to reproduce. |

56 Here there is some error — Observed, nature does nothing in vain, therefore organs fitted to animals place in creation. — thus senses, especially sight connected with locomotion. (Mem. Dr. Blackwell (Abercrombie)¹⁰ comparison of sight to threads.) — Hence the *Pecten* which moves imperfectly has eye-point, but Broderip added it has been stated that stationary Spondylus has eye-points — Macleay then answered, because nature leaves vestiges of what she does — does not move per saltum — yet does nothing in vain!! |

61 Waterhouse knows three species of *Paradoxurus*¹¹ common to Van Diemen's land & Australia. Well developed mammae in male ourang-outang other point of resemblance with man.

September 31^d Magazine of Natural History¹² 1838 II p. 492. Mr. Gould¹³ on Australian birds, all Eagles of Australia characterized by wedge tails, many of the hawks are analogous to European birds. also do. p. 403 & 404.

⁷ Sir Thomas Browne, *Works*, edited by S. Wilkin, London, 1835-6.

⁸ William Sharp MacLeay.

⁹ William John Broderip (*cf. Life & Letters of Darwin*, 1887, vol. 1, p. 274).

¹⁰ ? John Abercrombie, *Inquiries concerning the intellectual powers and the Investigation of Truth*, London, 1838.

¹¹ By "*Paradoxurus*" Darwin meant *Ornithorhynchus paradoxus*; personal communication from George Robert Waterhouse.

¹² Under the abbreviation "*Magazine of Natural History*", Darwin has confused two different publications which, unfortunately, both published a volume 2 in 1838: they were, *Annals of Natural History or Magazine of Zoology, Botany and Geology*, and, *Magazine of Natural History*.

¹³ John Gould, *Birds of Australia and the adjacent islands*, London, 1827-8. Neither journal mentioned in the previous footnote in vol. 2, p. 402 has a paper by Gould, but *Mag. Nat. Hist.* vol. 2, 1838, has, beginning on p. 399, a paper by Brehm, "Observations on some of the domestic instincts of Birds"; on pp. 402-4 there are references to birds of prey.

Vol. II do. (p. 71) allusion to Eyton's discovery of different number of vertebrae in Irish¹⁴ & English hare. good case these hares compared to South American hares, many species separated by mountains &c &c &c |

- 62 do. p. 69, a Dr Macdonald¹⁵ believes the Quaternary arrangement & not the Quinary. anyone may believe anything in such rigmarole about analogies & numbers.

L'Institut p. 275 (1838) Mr Blainville¹⁶ has written paper to show Stonesfield Didelphis not Didelphis. answered satisfactorily by Valenciennes.

- The change from caterpillar to butterfly is not more wonderful than the body of a man undergoing a constant round, each particle is placed in place of last by the ordering of the nerves, but in different parts according to age of individuals (see
63 mammae of women) in different parts when age | *changes* caterpillars into Butterfly. When two varieties of dog cross, Erasmus says it looks like . . . |

- 64 Institut 1837 p. 351 Paradoxurus Philippensis. Philippines . . .¹⁷ |

- 73 as at present in new Ireland & continent since grown. — This will explain S. American case of Didelphis being mundine form., & the less development of Marsupials in S. America. from presence of Edentata — Edentata & Marsupials have been almost destroyed wherever other animals existed. —

Athenaeum 1838. p. 654 Reason given for supposing Tetrao Rakkelhan a hybrid produced commonly in Nature both in Sweden & anciently in Britain) between *hen* Capercaillie & cock Black-cock.¹⁸ — (Curious the readiness with which this genus becomes crossed. ?is red game an hybrid? — |

- 74 When I show that islands would have no plants were it not for seeds being floated about, — I must state that the mechanism by which seeds are adapted for long transportation, seems to imply knowledge of whole world — if so doubtless part of system of great harmony.

The peculiar character of St. Helena. — contrast with Otaheiti in relation (See Gaudichauds¹⁹ Volume on the Botany of the Pacific.) to nearest continent. — with respect to ancient geography of Atlantic Tristan D'Acunha ditto. Juan Fernandez do |

- 87 which is often the case, & why should organic affections always influence the sexual organs alone. —

It is singular pheasant & fowl being so totally infertile whereas animals further apart have bred inter se. —

These hybrids are very wild & take in disposition after their pheasant parents. —

¹⁴ William Thompson, "On the Irish hare", *Ann. Nat. Hist. or Mag. Zool. Bot. & Geol.*, vol. 2, 1838, p. 70; on p. 71 there is an allusion to Thomas Campbell Eyton's discovery that the tail of the Irish hare is shorter and has 3 less vertebrae than the tail of the English hare.

¹⁵ *Ann. Nat. Hist. or Mag. Zool. Bot. & Geol.*, vol. 2, 1838, p. 69 reports a verbal communication to the Royal Society of Edinburgh on 9 April 1838 by Dr Macdonald.

¹⁶ Henri-Marie de Blainville, "Doutes sur le prétendu Didelphie fossile de Stonefield [*sic*]", *L'Institut*, tome 6, 1838, p. 275.

¹⁷ *L'Institut* 1837. p. 351 " . . . Zoologie : *Mammifères nouveaux*. — M. Jourdan présente un mémoire dans lequel il décrit cinq Mammifères . . . 5° Paradoxure des Philippines (*Paradoxurus Philippinensis* J.) . . . "

¹⁸ *Athenaeum*, 1838, p. 654: "Dr Charlton exhibited a specimen of *Tetrao Rakkelhan*, of Temminck, and read a short notice, to prove that this bird, though described as a distinct species, . . . was in fact nothing but a hybrid, between the hen capercaillie and blackcock".

¹⁹ Charles Gaudichot-Beaupré, *Botanique du Voyage autour du monde fait sur l'Uranie et la Physicienne*, Paris, 1826. The author of the entire work is Louis de Freycinet.

(There are some $3/4$ birds of which I think there must be some mistake in their origin)

Saw cross between Penguin Duck from Bombay & Canada Goose. — Former strange mishaped bird & looks very artificial bred but Mr. Muller says that breeds
88 larger numbers, & rears an | unusual number out of any one nest, even more than common duck — Male Penguin was crossed with hen Canadian offspring, I should say in every respect most like Penguin duck. — *which is strange anomaly in Yarrells Law.*²⁰ — it probably is explained by the vigour of their propagating powers. (as if they were a good species or local variety & not effect of breeding in & in, like our pigeons).

The male of every animal certainly seems chiefly to impress the young most with its form & disposition |

89 Saw there young duck, like each other, — (& not very like either either . . . or Pintail ducks) from which they were descended they . . . from $1/2$ pintail drake into pintail. — of them there were four two like each other & two dark coloured & different. — the former were the parents of the little ones |

90 Same man crossed Jackal & dog (offspring did not go to teat but parts swelled, though no fluid came from them. — showing how gradually every change is effected) — the one in the garden is from father dog & hence general appearance of face & tail somewhat like dog — though it has full share of Jackal shape |

101 of white speckles on elbow joint — in Bewick drawing²¹ the the rock Pidgeon has not : now how many wild pidgeon have *spangles* on this part : this will be well worth working out. —

Study Temmincks²² work on Pidgeons, & see whether feathered legs, — car[r]uncles on beak as in Muscovy duck, crested feather, pouters, fan tails, are found in any *colours* of plumage &c &c. Pouting pidgeon exaggeration of cooing. — & compare them with all the varieties. — Habits of rock pidgeon. — (I suspect *Pennant*²³ has described them) — (Study horns of wild cattle. — & plumage of fowls — *long ears* of rabbits. — & long fur. — feathers on legs of Ptarmigan & in Bantam. —) In the Pidgeons trace the washing out of the forked band, like in plumage of ducks. — |

102 Mr. Yarrell says in very close species of birds, habits when well watched always very different. — the two redpoles can hardly be told apart, so that after differences were pointed out Selby confounded them, yet can readily be told by incubation & other peculiarities. — (Mem. Goulds Willow Wren.) — (Goulds story of Water-Wagtails mistaken both species scattered over Europe) — The habits of some same North American & European birds slightly different — Barn Owl in the former place breeds in thick vegetation in swamps — owing to barn, perhaps not being left open to them. — In singing birds, part instinctive & part acquired — thus Yarrell has Lark & Nightingale which both sing their own songs though imperfectly. — Male birds always *record* their songs, it |

105 In Scandinavia besides the Rakkehan before mentioned between Capercailzie &

²⁰ See "Darwin's Fourth Notebook on Transmutation of Species", *Bull. Brit. Mus. (Nat. Hist.) Historical Series*, vol. 2, 1960, p. 173, footnote 1.

²¹ *Ann. Mag. Nat. Hist.*, vol. 2, 1838, p. 174.

²² Coenraad Jacob Temminck, *Histoire naturelle générale des pigeons*,

²³ Thomas Pennant, *Genera of Birds*, Edinburgh, 1773.

Black Cock. — the latter has crossed with the Ptarmigan *subalpina* in wild state. — Neilson²⁴ has given figure of it. — In England no doubt the cross between Pheasant & Black game is owing to their rarity, as single female in wood with Pheasants would sure to be trod & in many parts of Scandinavia these birds are very far from common. — Under this predicament, probably, alone would species cross in wild state. — Is English red Grouse a cross between Black game & the *subalpina* of Sweden, (which in summer dress somewhat resembles Red Grouse) it may be so — but very improb-

ably, for it can hardly be | thought that the cross would have adapted it to changing
 106 circumstances. — More probably during known changes climate became unfit for *subalpina*, or some northern species, & being restricted species has been made. — In the hybrid grouse between Black Cock & Ptarmigan (probably *subalpina*) former has blue breast, latter reddish, hybrid purple — *be careful*. See to hybrids between Pheasant & Black Cock & other hybrids.

The fact of Egyptian animals not having changed is good — I scarcely hesitate to say that if there had been considerable change, it would have been greater puzzle, than none, for the enormous time |

133 Lyells Elements.²⁵ p. 290 Dr Beck on numerical proportion in shells in Arctic Ocean. p. 350 Grallae in Wealden oldest birds. p. 411 Decapod Crust in Muschelkalk & 5 genera of reptiles. — p. 417 Magnesian Limestone & Zechstein oldest rocks in which reptiles have been found. p. 426. Sauroid fish in coal. true fish & not intermediate between fish & reptile — yet osteology closely resembles reptiles. p. 432 some plants in coal supposed to be intermediate between coniferous trees & Lycopodium. — p. 437 Many existing genera of shells in the mountain limestone (how different from plants!) But the Cephalopoda depart more widely from living
 134 forms. — p. 458 Upper Silurian fishes oldest formation highly organized. — | do. p. 461 Lower Silurian — several existing genera — Nautilus, Turbo, buccinum, turritella, terebratula, orbicula, with many extinct forms & Trilobites.

Sept. 25th In considering infertility of hybrids inter se. the first cross generally brothers & sisters & therefore somewhat unfavourable. —

28th We ought to be far from wondering of changes in numbers of species, from small changes in nature of locality. Even the energetic language of Decandolle does not convey the warring of the species as inference from Malthus. — increase of brutes must be prevented solely by positive checks, excepting that famine may stop desire. — in nature production does not increase, whilst no check prevail, but the positive check of famine & consequently death. I do not doubt every one till he thinks deeply has assumed that increase of animals exactly proportionate to the number that can live. — . .

135 Population is increase at geometrical ratio in FAR SHORTER time than 25 years — yet until the one sentence²⁶ of Malthus no one clearly perceived the great check

²⁴ Sven Nielson, *Ornithologia Svecica*, Hafniae, 1817–21.

²⁵ Sir Charles Lyell, *Elements of Geology*, London, 1838.

²⁶ This note, written on 28 September 1838, makes it possible to identify the sentence in T. R. Malthus's *Essay on the Principle of Population* which enabled Darwin to see how the pressure of natural selection is inevitably brought to bear. It was in the 6th edition, London 1826, vol. 1, p. 6: "It may safely be pronounced, therefore, that the population, when unchecked, goes on doubling itself every twenty five years, or increases in a geometrical ratio".

amongst men. — there is spring, like food used for other purposes as wheat for making brandy. — Even a *few* years plenty, makes population in man increase & an *ordinary* crop causes a dearth. take Europe on an average every species must have same number killed year with year by hawks, by cold &c. — even one species of hawk decreasing in number must affect instantaneously all the rest. — The final cause of all this wedging, must be to sort out proper structure, & adapt it to changes. — to do that for form, which Malthus shows is the final effect (by means however of volition) of this populousness on the energy of man. One may say there is a force like a hundred thousand wedges trying [to] force every kind of adapted structure into the gaps in the oeconomy of nature. or rather forming gaps by thrusting out weaker ones. — |

- 136 D'Orbigny²⁷ Comtes Rendus p. 569. 1838 says the cross between the Guaranis & Spaniards are almost white from first generation, that with Quichuas the American character is more tenacious & does not disappear for many generations.

Sept 29th Dr Andrew Smith. Remarks on extraordinary curiosity of Monkeys. The Baboon of which anecdotes have been told is *Cynocephalus porcarius*. — This monkey did not like a great coat made for it at first, but in two or three days learn its comfort & though could not put it *on*, yet threw it over |

- 151 The present age is the one for large Cetacea, as the past for other Mammalia, & still further back reptilia & Cephalopoda.

Old Jones²⁸ remarked to me that one of the children of Sir J.H. was so like Sir W. whilst Sir J. is himself not like — now this is a clear case of avitism. but then? was not the expression of Sir W. itself received from his father so that case ceases to be true avitism

Annals of Natural History²⁹ p. 135 Natural History of the Caspian Fresh water Fish!! ?adapted to Salt Water? — peculiar species. crabs & molluscs few. — ?are not some same — what is the alliance with the Black Sea. — it would be ocean. what is land to continent — Original Paper worth studying. Archiv fur Naturgeschichte.³⁰ |

- 152 September 11 *Generation* Mr. Yarrell says it is well known that in breeding very pure South Down that the ewe must never be put to any other breed else all the lambs will deteriorate. — Lord Moreton's³¹ case —

When cows have twins, though capable of producing both pair of male & female. — if there be one female, she will be free Martin.³² See Hunter's Owen —

²⁷ Alcide Dessalines D'Orbigny, "L'Homme américain (de l'Amérique méridionale), considéré sous ses rapports physiologiques et moraux", *Comptes Rendus Acad. Sci. Paris* tome 7, 1838, p. 569.

²⁸ Unidentified.

²⁹ *Ann. Mag. Nat. Hist.*, vol. 2, 1838, Bibliographical Notices, p. 135, refers to subject of following footnote.

³⁰ E. Eichwald, Einige Bemerkungen über das kaspische Meer", *Archiv. für Naturgeschichte*, 4ter Jahrgung, Bd. 1, pp. 97-112, . . . ; on p. 97: "Wenn gleich die grösste Zahl der Fische des Meeres Flussfische sind, die jedoch als solche nicht an den Mündungen der grösseren Flüsse, also da, wo das Seewasser süß ist, leben, so finden sich dennoch mehrere Arten, und zwar aus Gattungen, die bisher nur im salzigen Seewasser beobachtet wurden".

³¹ cf. "Darwin's First Notebook on Transmutation of Species", *Bull. Brit. Mus. (Nat. Hist.) Historical Series*, vol. 2, 1960, p. 63, footnote 7.

³² John Hunter, *Observations on certain parts of the Animal Oeconomy*, with notes by Richard Owen, London, 1837, p. 34, "Account of the Free-Martin".

In the *Athenaeum*³³ Numbers 406, 407, 409 Quetelet papers are given & I think facts there mentioned about proportion of sexes, at birth & causes. |

- 159 they first appear occupy their *proper* positions, — this would be argument for development of either. — (Mammae or sheath of horses penis reduced to extreme degree of abortion). — Insecta. — hermaphrodite. being not only dimidiate, but quarter grown seems to show whole body imbued with possibility of becoming either sex. — In my theory I must allude to separation of sexes as very great difficulty, then give speculation to show that it is not overwhelming. —

Seeing in Gardens of Hybrids between common & Silver Pheasant, one like cock & other like hen — one doubts whether they are not Hermaphrodites, like J. Hunters Free Martin. N.B. the common mule must often have been dissected. |

- 160 Zoolog. Garden. Sept. 16. Hybrid between Silver & common Pheasant. Mule bird, said to be infertile. — spurs rather smaller than in silver male — Head like silver except in not having tuft. — back like do. — but the black lines on each feather instead of coming to point are more rounded. & much broader, & three I believe, instead of two lines, faintly edged with reddish brown — black marks on tail much broader. — Breast red like common pheasant — lower part of breast each feather is fine metallic green with tip & part of shaft metallic green. — This green doubtless is effect of metallic hue of silver pheasant. yet why green? & not purple? — leg pale coloured. — In the back feathers, we have character different from either parent bird — |

- 173 the manner in which frogs copulate & fish show how simply instinctive the feeling of other sex being present is — it also shows that semen must actually reach the ovum. — [Why in making a bud, which is to pass through all transformations should there need two organs; whilst in common bud there is no such need. — one would suppose that the vital portion ?nerves? passed through transformation & was received into bud matured by female: such view no way explains Lord Moreton's case: without the nervous matter consists of infinite numbers of globules: generally sufficient for one birth or other] II. It should be observed that the constant necessity for change in process of generation applies only [to] the more complicated animals.

p. 310 She wolf took dog³⁴ but had such aversion to it, that she was held. Hunters Oeconomy. So with inter-breeding as told by Willis³⁵ |

- 174 v. infra p. 179 continued from

Is a flower bud produced by union of two common buds ??? Amongst buds each one exactly like its parents. all alike in one parent or tree, but not in other trees. — Why should there be a necessity that there should be something each time added to that kind of generation, which typifies the whole course of *change* from simplest

³³ Adolphe Quételet, "On Man and the Development of his Faculties, &c." *Athenaeum*, nos. 406 407, 409, 1835; pp. 593-5, 611-3, 658-61; on p. 611: "an examination of births registered in France during a lapse of fourteen years, that the average number of male births to female was 106.38 to 100 . . . he proceeds to inquire into the external circumstances by which these proportions may be partially affected; . . . that the number of male births is relatively less predominant in cities than in agricultural districts".

³⁴ John Hunter, *op. cit.*, p. 323: "she would not allow any dog to come near her . . . She was held, however, while a greyhound dog lined her".

³⁵ cf. "Darwin's Second Notebook on Transmutation of Species", *Bull. Brit. Mus. (Nat. Hist.) Historical Series*, vol. 2, 1960, p. 110, footnote 4.

form. — (Because by the process it separates those differences which are in harmony with all its previous changes, which mutilations are not). but why should it demand some further change? Man properly is hermaphrodite (hence monstrosities tend that way from frequency of this tendency all mammals must long have so existed with double union.[])] — At present I can only say the whole object being to acquire differences, indifferently of what kind, either progressive improvement or deter[ioration] . . that object failing, generation fails. — How completely *circumstances* alone make changes or species !! The view of each man or mammalia being abortive hermaphrodite simplifies case much ; & originally each hermaphrodite being simple (are not coniferous trees generally dioecious oldest forms) |

Pages excised from Fourth Notebook

IV

- 5 Those who have studied history of the world most closely & know the amount of change now in progress, will be the last to object to the theory on the score of small change — on the contrary islands separated with some animals &c. — If the change could be shown to be more rapid I should say then some link in our train of geological reasoning extremely faulty.

The difficulty of multiplying effects & to conceive the results with that clearness of conviction, absolutely necessary as the basal foundation stone of further inductive reasoning is immense.

It is curious that geology by giving proper ideas of these subjects should be *absolutely* necessary to arrive at right conclusion about species.

- 6 Changes of level &c. are easily recorded, but change of species not as — without every animal preserved. the latter pages in the history are perfect, | we obtain a glimpse only of the changes which the government is subject to. — further back we obtain here & there in order a scattered page, we find sensible change in the institutions & we suppose not only revolutions, but certain obliterations & first laws created, & yet with symmetry & regular laws that baffles idea of revolution. —

My very theory requires each form to have lasted for its time: but we ought in same bed if very thick to find some change in upper & lower layers. Look at whole Glacial period — Good objection to my theory: a modern bed at present might be very thick & yet have same fossils. does not Lonsdale¹ know some case of change in entire series |

- 9 Study introduction to Cuviers² Règne Animal.

No structure will last without it is adaptation to *whole* life of animal, & not if it be solely to womb as in monster, or solely to childhood, or solely to manhood. — it will decrease & be driven outwards in the grand crush of population. —

Octob. 10th. Saw two undoubtedly rabbits in poulterer shops, of same colour as a Hare, but paler & buffer — with long ears & longer hind legs ??? — so that I was almost doubtful which it was. — do hind legs increase in any rabbits |

- 10 One may strongly suspect that breeding in & in, produces bad effects solely, because of similarity, because in every country, where only pair has been introduced, & have freely bred, they have not lost power of producing.

Williams Narrative of Miss. Enterprise³ p. 497. Vampire bats abound in the Navigators & at Manguia, but are unknown eastward of the Navigators. Snakes occur there, but are unknown in Henry or Society isles. |

- 11 Hope⁴ says positively he has seen a Calosoma (very like American form) in Stonesfield slate, & a Melolon . . . [?] In marl from Lake Constance species of European genera =. — Hope has idea about generic character dominant predominant &c. having relation to geographical distribution. — Thus Hattica is such genus. — because found in all quarters: his ideas not clear. In Australia some approach to

¹ William Lonsdale.

² Georges Cuvier, *Le règne animal*, Paris 1817.

³ John Williams, *Missionary enterprises in South Sea Islands*, London 1837.

⁴ Frederick William Hope, personal communication.

Asiatic in part near Timor, & to European in Van Diemens land where there is close species of elater — Where this collection is particularly rich as in Lucanidae less difficulty in establishing good groups. — |

- 12 ears varying so much. — kind of fur (do tips of ears take any colour?) — length of tail varies & character of fur — I am sure a very good case might be made out of variation analogous to specific variations. —

Kerrs⁵ Collect of Voyages Vol. 8 p. 46 Capt. Davis in 1598 found cattle in Table Bay with Hump on their back & big-tailed sheep.

do. Vol. 10. p. 373 & 374 Spaniards say no Tortoises in the place besides Galapagos⁶ |

- 13 do. 376. Isle Tres Marias off Mexico with small Hares & *raccoons* S. American form — off province of Guadalaxura⁷ —

October 11th. — Uncle John⁸ says Decandolle⁹ distributed seeds of Dahlia all over Europe same year. — he sowed them for four generations before they broke. — showing effects of cultivation gradually adding up. & four more generations before they began to double. —

- At present time Uncle J. does not suppose one aboriginal variety for they are all
14 made by fertilizing | one plant with another — Uncle John says he has no doubt bees fertilize enormous number of plants — it is scarcely possible to purchase seeds of any cabbage where a great many will not return to all sorts of varieties, which he attributes to crossing. — Cape Broccoli can hardly be reared without greatest care be taken to prevent fertilization from turnips & other stocks. Says if any variety of apple be sown, all |

- 19 in the cats, the joints near the tip of the tail were generally crooked, as if they had been broken". are born so in all Malay countries W. Earl.¹⁰ Eastern Seas, p. 233.

Octob. 12. Kotzebues¹¹ Second Voyage Vol. II, p. 344. account of insects of St Peter & St Paul in Lat 53° yet fauna like that 60° & 70° of Europe. — Many European insects. list given — some peculiar —

do. p. 359. At Manilla a small Cercopithecus., & skins of Galiopithecus. —

Malte Brun¹² Vol. XII p. 133 at Samar SE of Luçon, many monkeys, buffaloes &c &c — Malte Brun would be worth skimming over with regard to this archipelago |

- 20 Octob. 13th. — Kotzebues First Voyage¹³ Vol. II p. 867. "The Fauna of the Sunda islands presents us, for the most part, with the same families and genera,

⁵ Robert Kerr, *A General History and Collection of Voyages and Travels* . . . London, 1811–1824 ; vol. 8, p. 46 : " Their cattle are large, and have a great lump of flesh on the shoulder, like the back of a camel. Their sheep have prodigiously large tails, entirely composed of fat, weighing twelve or fourteen pounds, but are covered with hair instead of wool ".

⁶ *ibid.*, vol. 10, p. 373 : " The Spaniards say there are no others in these seas, except at the Galapagos, but they are common in Brazil ".

⁷ *ibid.*, vol. 10, p. 376 : " The *Tres Marias*, or Three Marias, off the Western coast of Guadalaxara, in the kingdom of Mexico . . . There are also many excellent hares, but much smaller than ours. We saw likewise abundance of guanas and some racoons, which barked and snarled at us like dog ".

⁸ John Hensleigh Allen of Cresselly.

⁹ Augustin Pyramus de Candolle.

¹⁰ George Windsor Earl, *The Eastern Seas ; or Voyages and Adventures in the Indian Archipelago in 1832, 1833, and 1834*, London, 1837 ; p. 233 : " Here, as in all Maya countries I noticed a peculiarity in the cats, which I never heard satisfactorily accounted for. The joints near the tip of the tail are generally crooked, as if they had been broken ".

¹¹ Otto von Kotzebue, *New Voyage round the World, 1823–1826*, London, 1830.

¹² Conrad Malte Brun, *Annales des voyages*, Paris, 1809–14.

¹³ Otto von Kotzebue, *Voyage into the South Sea and Beering's Straits 1815–1818*, London 1821.

- that are natives of S. Asia, but many of the *species* are peculiar to them". do. p. 368 "Several kinds of animals have spread from the end of Borneo to the adjacent island — In Soolos we find the elephant — in Magindaneo several kinds of the large monkeys. — Fewer mammalia have passed to Paragua & in Luçon the most northern of the group the number is limited["] |
- 21 do. Vol. III p. 77 Kotzebues Second Voyage Many foreign plants have been introduced in Guahon (Mariannes), "for example the prickly *Limonia trifoliata*, which cannot now be checked". — Marsden¹⁴ p. 94 (1st Edit) of Sumatra has given account of Buffalo of the East which differs from that of S. Europe —
p. 189 The giant kind of crocodile sometimes wanders from Pellew to Eap [Yap] — There is another great Lizard, Kalug, which is found at Pellew & Eap, but not at Feis (near island) |
- 22 do. p. 190. The inhabitants of Summagi, a territory in the small isl^d of Eap in the Carolines are remarkably short. — & Deformations are particularly common. — without arms, hands, thumbs, — one leg, hare lip &c. &c. In Vol II p 363 account of Flora of Pacific. given in my coral paper.¹⁵
Oct. 14th. Macleay¹⁶ says that any character even colour is *good* (i.e. invariable) in some classes. — it is because every part is under change, now one part now another — |
- 25 Octob. 19th. When reading l'Institut 1838 p. 329. Milne Edwards¹⁷ description of curious mechanism of respiration or rather ventilation peculiar to some orders of crustacea, one is tempted to think that it must have been invented all at once. — but naturalists if they had series perfect, would expect this structure would become obscure & therefore it might then have arisen, & M. Edwards p. 330 distinctly states that the flipper is a mere simple modification of an organ present in whole class. |
- 26 Case of Mexican greyhounds. — young being habituated instance such as Hunter,¹⁸ or some one mention of influence on parent affecting offspring. — & as *adaptation*. — however mysterious such is case. therefore chance & unfavourable conditions to parent may be become favourable to offspring: Australian dogs having mottled coloured puppies case of this. — tendency in manner of life to be mottled & hereditary *tendency* determines the puppies to be so. — |
- 35 ARGUMENT REAL of antiquity of reasonable cosmopolite man. l'Institut¹⁹ 1838 p. 338. *Important account* of cross of sheep & Moufflon of Corsica, sadly against Yarrell's law. — not so much against my modification of it — Goat & Moufflon will not breed —

¹⁴ William Marsden, *History of Sumatra*, London, 1783.

¹⁵ Darwin's paper on Coral Islands, written in 1835, has been published, with an introduction by D. R. Stoddart, by Pacific Science Board, National Academy of Sciences, Washington D.C., Atoll Research Bulletin No 88, 15 December 1962.

¹⁶ William Sharp MacLeay, personal communication.

¹⁷ Henri Milne-Edwards, *L'Institut*, tome 6, 1838, p. 329: "un système de palettes qui fonctionnent à la manière des ventilateurs et opèrent le renouvellement de l'eau par appel, en rejetant sans cesse au dehors une portion du liquide contenu dans la cavité branchiale".

¹⁸ John Hunter, *Observations on certain parts of the Animal Oeconomy* with notes by Richard Owen, London, 1837.

¹⁹ *L'Institut*, tome 6, 1838, p. 338. Zoologie: *Metis du Moufflon et du Mouton*. — "M. Flourens donne lecture d'une note de M. Marcel de Serres sur un métis provenu de l'accouplement du Moufflon et du Mouton . . ."

p. do — ²⁰Fish of Teneriffe. St. Helena & Ascension most species like & *identical* with S. America & many very *close*. See full paper A most grave source of doubt in distinguishing which parent impresses offspring most is whether mother has had any offspring before — now this is never stated. |

- 36 Regarding the similarity of offspring to Parent same laws appear to hold good with regard to marriage of individuals & varieties of same species & to different species — sometimes like one parent & sometimes other & sometimes $1/2$ way. Ed. New Phil. Transact²¹ Rabies common to men dogs horses cows pigs & sheep — disease common for men and animals cowpox — case in Spain of pustulous disease following handling sheep — all case do. p. 354 The most vicious dog will not attack any animal except dog when absent |

- 41 *Vegetation* & conchology. — shells of Africa ought most to resemble fossil ones of Europe. Consider probable form of land. — S. America, an island, connects with Asia between two polar lands. — Africa not so *equatorial*. —

The fact of no Mam : Placent : insectivore being in S. America & Australia reason why Marsupiaata when fresh introduced live & multiplied specifically & individually. — |

- 42 I see clearly from F.R.²² it will be highly necessary to show that if species fall, genera must. Lesson²³ I remember says Mariana Deer very close to a Molucca species. —

L'Institut 1837, p. 253 on animals of Antilles.²⁴ (see Macleay²⁵ in Zoolog. Journal on those of Cuba. — It is important to understand well the relation of passage from N. to S. American forms.

The climate of N. America must have been *equable* & *far* more so than any other part of the World. — Europe perhaps less so than either Americas. — |

- 85 Decem. 21st L'Institut²⁶ 1838 p. 414 M. Eichwald has published Fauna of Caspian. — fishes fresh water kinds (yet living in the Salt ?) — very few animals of any kind — Fauna must be very curious — with respect to the non-development of Mollusca, which I have sometimes speculated might be owing to absolute quantity of vitality in the world : — *the production of vitality*, as argued by Müller from propagation of infinite numbers of individuals from one of adverse. — |

²⁰ L'Institut, tome 6, 1838, p. 338. Géographie Zoologique : Poissons des îles Canaries. — "M. Valenciennes lit des considérations sur l'ichthyologie de l'Atlantique et en particulier sur celle des îles Canaries . . ."

²¹ Edinburgh New Philosophical Journal vol. 24, 1838, p. 353 "Observations on Rabies or Madness in Dogs, Oxen, Horses, Pigs, and Sheep. by Dr. Wagner . . ."

²² Dr Sydney Smith suggests that Darwin intended to write "F.B." meaning Sir John Richardson's *Fauna Boreali-Americana* . . ., London, 1829-1837.

²³ René Primevère Lesson, in Louis Isidore Duperrey, *Voyage autour du monde . . . sur la corvette La Coquille*. Zoologie, Paris, 1826-1830.

²⁴ P. Gervais, L'Institut, tome 6, 1838, p. 253 : "Zoologie : Mammifères . . . communique une note sur les animaux mammifères des Antilles"

²⁵ William Sharp MacLeay, "Notes on Capromys", *Zool. Journ.* vol. 4, 1829, p. 269 ; cf. "Remarks on the Comparative anatomy of certain birds in Cuba", *Trans. Linn. Soc. Lond.*, 16, 1833, p. 1.

²⁶ L'Institut, tome 6, 1838, p. 412 *Chronique*

"— Un travail de M. Eichwald récemment publié sur la faune de la mer Caspienne a donné à ce savant l'occasion de combattre l'opinion que la mer Caspienne aurait été primitivement unie à la mer Noire. Il se fonde dans cette conclusion sur la différence qui résulte de la comparaison des faunes des deux mers. Le plus grand nombre des Poissons de la Caspienne sont des Poissons d'eau douce. Cette mer est de la plus grande pauvreté en animaux marins, surtout quand on la compare à la mer Noire. Et cependant, dit M. Eichwald¹ si les deux mers avaient été autrefois en communication, on ne devrait trouver dans l'une aucune espèce qui ne fût également dans l'autre".

- 86 Decemb. 25th Lyell says the elevated shells in Bayfields district are much more like those of Scandinavia than of the N. American species — Dr Beck says the shells in Scandinavia from height of 200 & 300 ft. are identically same as those of present seas. — now in this country we have better means of judging the *slowness* of physical changes, than in any other. & yet 200–300 ft. no elevation & no change & even no loss of species. |
- 87 It must never be overlooked that the chronology of geology rests upon amount of physical change & only secondarily, by assumption well grounded, on time; — therefore the mere loss of species, which may be the works of a few years as with the Lamantin of Steller^{26A} tells much less though it also the effect of change, than a slow gradation in form which must be effect of slow change & therefore precludes effects of catastrophes, which must serve to confound our chronology. CONSIDER ALL THIS. — Extinction & transmutation, two foundations, hitherto confounded, of geology. — |
- 88 L'Institut 1838. p. 414 M. Guyon²⁷ thinks monsters more common in Africa than in Europe especially with Europeans settled there.
L'Institut do. p. 419. long account of Hyaenodon, a fossil dog leading towards Hyaena.²⁸ — See Comte Rendu. — I suspect good case of fossil filling up blank. — not between existing series of species of dog & Hyaena. — but a common point. whence both may have descended. — |
- 91 continent. in like manner as Madagascar does to otherside of Africa. — (Juan Fernandez to Chile ??) Falklands to southern portion. Annals of Nat. Hist.²⁹ 1838 — do p. 269 on fresh water fish peculiar to Ireland.³⁰ do. p. 283. on the dark ears of the wild Chillingham cattle,³¹ with reference to Mr. Bell's³² statement of the tame ones, — an instance of a trifling peculiarity not to be eradicated. — do. p. 305. — Mr. Owen³³ says in abstract in his paper on the Dugong, "The generative organs being those which are most remotely related to the habits & food of an animal, I have always regarded as affording very clear indication of its true affinities. We are least likely in the modifications of these organs to mistake a merely *adaptive* to an *essential* character" — How little *clear* meaning has this to what it might have. — |
- 92 What is the difference between an *essential* character & an *adaptive* one. — are not the essential ones eminently adaptive. — Does it not mean *lately* adapted or trans-

^{26A} Stellers Sea-cow.

²⁷ M. Guyon, *L'Institut*, tome 6, 1838, p. 414: Tératologie, "en Afrique les monstruosités sont plus communes qu'en Europe".

²⁸ M. Laizer & M. Parieu, *L'Institut*, tome 6, 1838, p. 419; Paléontologie: Mammifère inconnu . . . "Description et détermination d'une machoire appartenant à un Mammifère jusqu'à présent inconnu . . . Hyaenodon".

²⁹ Edward Forbes, *Annals of Natural History*, vol. 2, 1838, p. 250: "On the Land and Freshwater Mollusca of Algiers and Bougia".

³⁰ William Thompson, *Annals of Natural History*, vol. 2, 1838, p. 269: "On Fishes; containing a notice of one Species new to the British, and of others to the Irish Fauna" (*Salmo ferox*, Lake Trout, in Lough Neagh, cf. *Proc. Zool. Soc.* 1835, p. 81.)

³¹ L. Hindmarsh, *Annals of Natural History*, vol. 2, 1838, p. 274, "On the Wild Cattle of Chillingham Park"; on p. 283: "in the colour of the ears there is a trifling difference, but this appears to be an occasional variety in the species".

³² Thomas Bell, *History of British Quadrupeds*, London, 1837.

³³ Richard Owen, *Annals of Natural History*, vol. 2, 1838, p. 305, reference to *Proceedings of the Zoological Society*, 27 March 1838, containing this statement.

formed & hence not indicative of true affinity. — Owen³⁴ says Dugong connected with Pachydermata. — p. 306. the Dugong cannot be united with true Cetacea or whales.³⁵ — but an aquatic Pachyderm & Walrus — aquatic seal — (Consult this passage when considering origin of Northern Cetacea). — do p. 318 M. Pictet³⁶ of writing of Goethe, alludes to difference between fossil & recent Bull : like fossil & recent shells of the new raised beaches.—who maintains that |

103 Sr C Bell³⁷ has some account of wolf in Zoolog. Gardens which brought its puppies to be fondled. — and we see in the Australian dog an instance of a half reclaimed animal.— the dogs, which have been wild here, have done so in hot countries. One ought to be able to hybridise the camel. Camel does not vary like ass & horse in lesser degree, how different to dog! (Hybrids of Calceolaria.) Same way some plants vary more than others : Does the Power of easily making tolerably fertile hybrids bear relation to capability of Variation? my theory says so. |

104 March 6th. Mr Bentham³⁸ says in Sandwich Isld. he believes there are many cases of genera peculiar to the group having species peculiar to the separate islands. In his work on the Labiatae some of these species are described. — capital case. — for Sandwich Isld^s are very similar to Galapagos — study Flora. what general forms. — are the Labiatae nearest to American or Indian groups? Believe some Mediterranean, but chiefly *mountainous* — this is very important (Sicily exception) see if this can be generalized—isld^s have peculiar |

115 Rhododendron ferrugineum begins at 1600 metres precisely & stops at 2600 & yet know that plant can be cultivated with ease near London — what makes the line, as of trees in Beagle Channel — it is not elements! — We cannot believe in such a line. it is other plants. — a broad border of killed trees would form fringe — but there is a contest & a grain of sand turns the balance. — M. Ramond p. 19 do. (Hort. Transact. Vol I)³⁹ says lofty Alpine plant of Pyrenees agree with those of Norway, Lapland, & Greenland. but not | with those of Kamtchatka, Siberia, or 116 even of polar regions of N. America. — if true curious on my view — because these points were last connected with those northern regions.⁴⁰ do. p. 21 says many

³⁴ Richard Owen, *ibid.*, p. 307 : " I conclude, therefore, that the Dugong and its congeners must either form a group apart, or be joined as in the classification of M. de Blainville, with the Pachyderm ".

³⁵ Richard Owen, *ibid.*, p. 306 : " Now we have seen . . . the junction of the Dugongs and Manatees with the true Whales cannot therefore be admitted in a distribution of animals according to their organization ".

³⁶ M. F. G. Pictet, " On the writings of Goethe relative to Natural History ", *Annals of Natural History*, vol. 2, 1839, pp. 313-322 ; on p. 321 : " his observations on the researches of Dr Jaeger upon the subject of fossil bulls found in the neighbourhood of Stuttgart. Goethe seeks to prove in this article, that the difference which exists between fossil and recent bulls may be looked upon as the result of the perfecting of the species during the centuries which separate the two periods ".

³⁷ Sir Charles Bell, *Anatomy and Philosophy of Expression*, London, 1806.

³⁸ George Bentham, *Labiatarum genera et species*, London, 1832-6.

³⁹ *Transactions of the Horticultural Society of London*, 1820 (3rd ed.) Appendix IV, p. 15 " On the Vegetation of high Mountains, translated from a Paper of M. Ramond's in the *Annales du Muséum*, vol. 4, p. 395." By Richard Anthony Salisbury . . . " On p. 19 " . . . Norway, Lapland, and Greenland, furnish plants analogous to those of the Swiss Alps and Pyrenees, but few, or possibly none of them, are seen in Siberia, Kamtschatka, or even in the polar regions of America. . . . "

⁴⁰ *ibid* p. 21 " . . . grow wild in the same place, and follow the same route. The *Anthericum Bicolorum* of Algiers, traverses the same chain of mountains, and arrives in Anjou. The *Scilla Umbellata* and *Crocus Mudiflorus*, have migrated from the Pyrenees even into England. Yet not one of the above mentioned vegetables has been disseminated laterally, to meet those southern ones which have crossed the Swiss Alps. . . . "

plants skirt each side of the great N & S valleys, which penetrate Pyrenees in branch valleys — M. Ramond offers no explanation.

- 119 Examine list of St Helena Plants & see whether those which grow in low ground are those, which are common & nearest being common to other parts of the world. —

March 16th Mr. Lonsdale showed me two specimens of an *Inoceramus* from the Gault of Folkestone, which is exactly intermediate between *I. concentricus* & *I. sulcatus*. — the beak of this one has concentric striae, all the lower part rayed longitudinally (give woodcut) like *I. sulcatus*. — Both species are | found at Folkestone. — 120 it is unnamed this intermediate one. — Mr. Lonsdale evidently inclines to think it *Hybrid* !!! Ask Woodward⁴¹

Mr. Lonsdale says *Trigonia costata* & *elongata* though considerably different in proportional dimensions must be considered merely varieties & even Mr. Sowerby is coming to this conclusion, from specimens in grades, now L. says that *T. costatus* | 121 is in England found in the Inferior Oolite, & the *T. elongata* in the Upper formation Portland Stones &c. &c. — if so it is good case : — In Sowerby⁴² Min. Conch. it is however, said they have been found *together* in coast of France. — L. doubts. — Lonsdale thinks Ammonites would afford instance of such facts. — Ask Phillips.⁴³ — |

- 122 The more I think, the more convinced I am, that *extinction* plays greater part than *transmutation*. — Do species *migrate* & *die* out? —

March 20th. Phillips in Lecture in Royal Institution says shells become less in number (?species or individuals) the deeper one goes — surely is this true? — most strange. — In the place where any species is most common, we need not look for change, because its numbers show it is perfectly adapted ; if where few stray ones are that change may be anticipated, & thus fresh creation. the gardener separates a plant he wishes to vary — domesticated animals tend to vary. |

- 123 Does not spermatic animalcule in Mosses render my view of the crossing of mosses & all others by action of wind difficult. —

Cline on the breeding of animals.⁴⁴ p. 8. size of foetus in proportion to male parent. p. 8. his whole doctrine of the advantage of crossing consists in the idea of the male being smaller, & the female larger than the average size : (surely this is very limited view though perhaps a true element) give examples : pigs with small chinese boar &c. &c. &c. Offspring take more after father than mother ; illustrated by the crossing of hornless sheep with horned. — compare this with what highland shepherd said. — |

- 124 p. 12. Attempts to improve the native animals of any country must be made with great caution ; owing to its adaptation to the surrounding circumstances. According to my theory no *land* animal with *fluid* seeds can be true hermaphrodite. —

Man probably assumes the hairy character of his forefathers only when advanced in age, & therefore the children do not (& in hairless kittens we see same fact) go

⁴¹ Samuel Pickworth Woodward (1821–1865) was 18 years old in 1839 which shows that this pencil note was added at a date later than that at which the Notebook was written.

⁴² James Sowerby, *Mineral Conchology of Great Britain*, London, 1812–46.

⁴³ John Phillips, author of *A Treatise on Geology*. *Lardner's Cabinet Cyclopaedia*, London 1837.

⁴⁴ Henry Cline, *Observations on the Breeding and Form of Domestic Animals*, London, 1829.

125 back, & this is argument against Blyth's⁴⁵ | doctrine of young birds retrogressing — Uncovering the canine teeth or sneering, has no more relation to our present wants or structure, than the muscles of the ears to our hearing powers.

E.⁴⁶ frowns prodigiously when drinking very cold water, frowns connected with pain as well as intense thought. —

No one but a practised geologist can really comprehend how old the world is, as the measurements refer not to revolutions of the sun & our lives, but to period necessary to form heaps of pebbles &c. &c. : the succession of organisms tells nothing about length of time, only order of succession. |

126 Splendid Pamphlet (published in *Philosoph. Journal* April 1st 1839) by Sedgwick & Murchison⁴⁷ ; which is a beautiful instance of *forms*, intercalated between two great distinct formations. — particulars are given p. 246–248 & 258.

A beautiful case showing the gradation from one grand system to another : in each system, the changes from limestone to san[d]stone &c. show some great change who can say how many centuries elapsed between each of these gaps. far more probably than during the deposition of the beds. — The argument must |

129 April 3^d. — Henslow⁴⁸ tells me following facts : believes that only red *Lychnis* grows in Wales & certainly only white in Cambridge. in some counties sometimes one & sometimes other. — there is some difference of habit between these varieties, so that they have been thought to be different species. *Lychnis dioica*, generally dioecious yet parts only very slightly abortive & bed of female flowers will sometimes produce a few seeds. — *Ruscus aculeatus* a dioecious plant, in which the male plant

130 sometimes | bears female flowers, the organ. are most clearly abortive, so that they become so by suppression of one organ. here language forces on us the change, which seems to have taken place. — Almost all Dioecious & monoecious plants have rudimentary abortive organs, even more so Polygamia : Monoecia & Dioecia, preeminently artificial, so that even some species only in genera have this structure. —

Some willow trees have been observed to change their sex. — this effect from age, what Mr. Knight⁴⁹ |

139 then dropped it & was found alive. Stanley's *Familiar History of Birds*⁵⁰ — several cases on record of stoats being carried (p. 121) & dropped having wounded the bird. p. 124 — Mr. Willoughby⁵¹ found a dead lamb & hare by the side of Eagles nest, which shows power of carrying great weight p. 125. is said that Eagles bring rabbits

⁴⁵ Edward Blyth, *Annals and Magazine of Natural History*, vol. 9, 1836, p. 402 : " Every modification of every successive type is thus rudimentally different from the most approximate modifications of every other equivalent type, or superior type, to which it does not appertain ; and this is the same conclusion to which I have been irresistibly led from consideration of various phenomena connected with the change in plumage which takes place in birds. As every species is perfectly and essentially different from every other species, so, except in a retrograde direction, are the successive typical and subtypical plans upon which they are severally organised ".

⁴⁶ Erasmus Alvey Darwin, Darwin's elder brother.

⁴⁷ Adam Sedgwick & Roderick Murchison, " Classification of the Older Stratified Rocks of Devonshire and Cornwall ", *Philosoph. Mag.* vol. 14, 1839, pp. 241–260.

⁴⁸ John Stevens Henslow.

⁴⁹ Thomas Andrew Knight.

⁵⁰ Edward Stanley, *Familiar History of Birds*, London 1838.

⁵¹ Francis Willoughby. In the 1854 edition of Edward Stanley's *Familiar History of Birds* " . . . Mr. Willoughby, an excellent authority, mentions a nest which he saw in the woodlands, near the river Derwent, in the Peak of Derbyshire, some 150 years ago. . . . and by them a lamb and a hare, and three heath-pouls. . . . "

& hares to the young ones to exercise them in killing them. "Sometimes it seems hares, rabbits, rats & not being sufficiently weakened by wounds get off from the young ones while they were amusing themselves with them and one day a rabbit
 140 escaped into a hole, where | the old Eagle could not find it. — The parent bird another day brought to her young ones the cub of a fox which after it had fought well & desperately bitten the young ones would in all probability have escaped" — if it had not been shot by a shepherd who was watching the scene. — In Shiart Isl^d it is said, that an Eagle always procured its prey from another island. —

p. 175. 28 short eared owls were counted in a field where there was great swarm of mice. — |

165 May 29th. — Henslow says that he has not the slightest doubt that *Festuca vivipara* is the same species with *F. ovina* & was rendered viviparous by growing in height. — yet he has seen it propagated in a garden, which is case precisely analogous to the Canada onion mentioned in Hort. Transact. *Aisa caespitosa* become viviparous on mountain & yet can be raised in gardens. — *Poa alpina*, though generally viviparous sometimes seeds. There are endless curious facts about every part of plant producing buds, so that Turpin⁵² says each cell of plant is individual. — Most plants which propagate rapidly by buds, layers &c. &c. do not seed freely. — The periwinkle seldom produces seeds, because it is thought to require insects to impregnate it. — it is allied to *Asclepia*, where this is always the case according to Brown. — |

166 Voyage of Adventure & Beagle.⁵³ Vol. I. p. 306 *Shells* as well as plants of Juan Fernandez differ from American coast. Vol. II p. 251 about the drifting of animals on ice — p. 643 — very curious table of all the castes from Stephenson at Lima.

The same numerical relation (both in species and subgenera) between the Crag & Touraine beds, the one with neighbouring & Arctic sea, & the other with neighbouring & Senegal in sea — is remarkable. — Again the resemblance between the Superga
 167 & Paris, numerically | the same with recent & yet almost wholly different, is same, as if Isthmus of Panama. — Those two cases highly improbable — yet I can see no other way of accounting for them. — Think over this — The Superga beds have many shells in common with Touraine & are not far distant, which as L. says is strong argument for their contemporariness. — How is this with the Eocene beds. — see Lyells⁵⁴ tables —

Bennetts Wanderings⁵⁵ Vol. II p. 155. By inference I imagine that there are Baboons in St. Thomas on W. coast of Africa. |

168 Owen⁵⁶ Linn. Soc. April 2^d 1839. The *Lepidosiren*. — *Amblyrhynchus* & *Toxodon*, all equally aberrant — the two former connecting classes like *Toxodon* in orders. — Fish & reptiles in former case — Reptiles & Birds & Mamm. in *Amblyrhynchus* — is not this right? —

⁵² Pierre-Jean-François Turpin, *Organographie microscopique des végétaux. Sur l'origine du tissu cellulaire*, Paris, 1829.

⁵³ Robert FitzRoy, *Narrative of Voyages of H.M.S. Adventure and Beagle*, London, 1839.

⁵⁴ Sir Charles Lyell, *Principles of Geology*, vol. 3, London, 1833, Table II, pp. 389–393.

⁵⁵ George Bennett, *Wanderings in New South Wales*, London, 1834.

⁵⁶ Richard Owen, "Description of the *Lepidosiren annectens*", *Trans. Linn. Soc. London*, vol. 18. 1841, p. 327; read 2 April 1839.

June 18th. Eyton⁵⁷ tells me that Yarrell⁵⁸ knows of a Gull which has laid in domestication eggs of two shapes & colour — Eyton has observed same thing in
 169 *Brent Goose* | Eyton says some of the pigeons in common Dovecot are very like a Himalaya species — *leuconotes*. —

Magazine of Nat. History 1839 p. 106. Waterhouse⁵⁹ refers to fossil remains of the Hamster. — is not this Siberian animal? —

Eyton⁶⁰ says that the young of two hatches all alike between the male Chinese & female common goose took after the common goose thus contradicting (probably) Yarrell's⁶¹ law & Walkers⁶² of the male giving form — they interbred & the young kept constant & all alike |

170 Waterhouse says some of the Galapagos Heteromera . . . [?] must come very near to Patagonian species. —

p. 18 of Temmincks⁶³ Preliminary discourse to Fauna of Japan. — that the animals of islands N. of Timor are allied to the type of genera in isles de Sonda as well by those which are identical, as those which are different — now this is same as Galapagos facts &c. &c. — & it shows the cause which gives same species to different isl^d. is the same as that which gives genera. — now in case of large |

173 Mr. Greenough⁶⁴ on his map of the world has written Mastodon found at Timor — thinks he has seen specimen in Paris Museum. —

Athenaeum 1839 p. 451. Sheep Merinos from Cape of Good Hope have different constitution from those of Europe⁶⁵ — for they stand India better than the latter. —

Forrest Voyage⁶⁶ p. 323. Sooloo imported elephant. wild hogs — spotted deer. no loories, but cocatores & small green parrots. |

174 June 26th — Yarrell: — Black Swan in domestication & nature strictly monogamous — geese polygamous (?when wild) but even some birds are so when wild — wild ducks monogamous; tame ones highly polygamous — change of instinct by domestication. —

"Notices of the Indian Archipelago" Published at Singapore in 1837. by Mr. J. H. Moore. — p. 1 Elephant Rhinoceros Leopard (but not Royal Tiger) &c. are found but only in one part the northern peninsula of Borneo. — Ox & hog natives of Borneo. |

⁵⁷ Thomas Campbell Eyton.

⁵⁸ William Yarrell.

⁵⁹ George Robert Waterhouse, "Observations on the Rodentia", *Magazine of Natural History*, vol. 3, 1839, p. 106.

⁶⁰ Thomas Campbell Eyton, "Some remarks upon the Theory of Hybridity", *Magazine of Natural History*, vol. 1, 1837, p. 357.

⁶¹ See "Darwin's Fourth Notebook on Transmutation of Species", *Bull. Brit. Mus. (Nat. Hist.)*, Historical Series, vol. 2, 1960, p. 173, footnote 1.

⁶² Alexander Walker, *Intermarriage*, London, 1838.

⁶³ Coenraad Jacob Temminck, "Aperçu général . . . sur les Mammifères qui habitent le Japon . . .", in P. F. von Siebold, *Fauna Japonica*, Leiden, 1833.

⁶⁴ George Bellas Greenough.

⁶⁵ *Athenaeum*, 1839, p. 451: "Asiatic Society . . . Agricultural and Horticultural Society of Bombay, in reply to a request for information respecting the breeds of cattle used in the Presidency. . . . Sheep are rare . . . Experiments are now making to improve the breed. . . . The merino from the Cape is found to answer much better than that brought from England".

⁶⁶ Thomas Forrest, *A Voyage to New Guinea, and the Moluccas, from Balmabangan*, London 1779; p. 323: "At Sooloo are none of those beautiful birds called Loories; but there is an abundance of diminutive cocatores, and small green parrots . . . Here are wild elephants, the offspring, doubtless, of those sent in former days from the continent of India, as presents to the kings of Sooloo . . . Sooloo has spotted deer".

- 175 Notices of Indian Arch. Singapore 1837 by J.H. ? J. H. Moore do p. 189, 190. No full sized horse is found East of y Bussamporter & S. of Tropic — after quitting Bengal the fact is noticed in Cassay Ava Pegue seldom equal 13 hands — those of Lao & Siam inferior to those of Pegu — in Sumatra they breed both small — Java pony occasionally reaches 13 hands. — Philippine Pony somewhat resembles that of Celebes is somewhat larger than the Sambawa Java & Sumatra breeds. (Here it appears there are shades of difference in all the isl^d. like in wild animals). — There are prevailing colours in the different islands. — The horse is only found wild in the plains of Celebes. (but language shows that probably not original there) — shows them isl^d not fit for horse. Forrest⁶⁷ (p. 270) says many wild horses, bullocks, & deer
- 176 South part of Mindanao. — | do. Appendix p. 43, 45. the *Breed* of elephants in little isl^d of Sooloo. — said to have been imported : shows they will propagate get dimensions. — do. App. p. 73 State of Muar in Malacca — speaks of Rhinoceros as well as *Tapir*. —

Journal of Asiatic Soc. Vol. V. p. 565 in a paper by Lieut. Newbold.⁶⁸ — A Malayan albino described "To this day the tomb of his grandfather, who was also an albino is held sacred by the credulous natives, & vow made at it. Both his parents were of the usual colour. His sister is an albino like himself said not to be common" — probably, I should think grandfather first of race & if so, fact for my theory |

181 that throughout the *Moluccas* Archipelago they are only to be found on the isl^d of Batchian near S.E. end of Gilolo.

- Forrest Voyage⁶⁹ p. 39⁷⁰ — deer but no wild animals in Gilolo. — p. 134⁷¹ Birds of Paradise were first produced from Gilolo. — p. 253⁷² In isl^d of Bunwoot (18 miles in circum) there are hogs and monkey near shore of Magindano |
- 182 Vol. do p. 634⁷³ alludes to the fact stated by M. Tournal that skulls found near Vienna approximate to Nigro forms ; those from Rhine to the Caribs. — Vol. II p. 650⁷⁴ Long attested account of fall of fish in India. — Windsor Earl. Eastern Seas p. 229⁷⁵. Believes the *Tapir* found in Borneo p. 233⁷⁶. There as well as all Malay countries the cats are born with the joint near the tip crooked. — is this form |

⁶⁷ Thomas Forrest, *ibid.*, p. 270 : "Here are many wild horses, bullocks and deer".

⁶⁸ J. T. Newbold, "Sketch of the State of Muar", *Journ. Asiatic Soc.*, vol. 5, 1836, pp. 561-7.

⁶⁹ Thomas Forrest. "A Voyage to New Guinea and the Moluccas, from Balamangan . . . London, 1779.

⁷⁰ *ibid* on p. 39 " . . . The island Gilolo abounds with bullocks and buffalos, goats and deer, also wild hogs, there are but few sheep, and no wild beasts. . . ."

⁷¹ *ibid* on p. 134 " . . . the Portuguese first found these birds on the island of Gilolo, the Papua Islands, and on New Guinea ; and where they are known by the name of passaros da sol, i.e. birds of the sun . . ."

⁷² *ibid* on p. 253 " . . . Saw a number of wild hogs . . ."

⁷³ *Journal of the Asiatic Society* vol. 2, Calcutta 1833. "Occurrence of the Bones of Man in the Fossil State" by [James] P[rinsep] p. 634 " . . . M. Tournal and other French naturalists, further suppose that several races of men have successively had possession of our continents. The form of the skulls found at Vienna is stated to approach to the African or Negro type. Those discovered in the fluviatile marls of the valley of the Rhine and Danube exhibit a close resemblance to the heads of the Karibs of those of the ancient inhabitants of Peru and Chili. . . ."

⁷⁴ *ibid* p. 650 Miscellaneous : "5. — Fall of Fish from the Sky".

⁷⁵ George Windsor Earl. "The Eastern Seas, or Voyages and Adventures in the Indian Archipelago, in 1832-33-34 . . ." London, 1837. On p. 229 " . . . and an animal, which, from the description given, must have been a *tapir*. . . ."

⁷⁶ *ibid.* p. 233 " . . . Here, as in all Malay countries, I noticed a peculiarity in the cats, which I never heard satisfactorily accounted for. The joints near the tip of the tail are generally crooked, as if they had been broken. I was at first inclined to doubt that they were born thus, but was afterwards convinced that such was the case. . . ."

