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978-1-108-00488-6 - The Foundation of the Origin of Species: Two Essays Written in 1842 and 1844 by Charles Darwin

Charles Darwin

Excerpt

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## PART I.

### § I. (ON VARIATION UNDER DOMESTICATION, AND ON THE PRINCIPLES OF SELECTION.)

AN individual organism placed under new conditions [often] sometimes varies in a small degree and in very trifling respects such as stature, fatness, sometimes colour, health, habits in animals and probably disposition. Also habits of life develop certain parts. Disuse atrophies. [Most of these slight variations tend to become hereditary.]

When the individual is multiplied for long periods by buds the variation is yet small, though greater and occasionally a single bud or individual departs widely from its type (example)<sup>1</sup> and continues steadily to propagate, by buds, such new kind.

When the organism is bred for several generations under new or varying conditions, the variation is greater in amount and endless in kind [especially<sup>2</sup> holds good when individuals have long been exposed to new conditions]. The nature of the external conditions tends to effect some definite change in all or greater part of offspring,—little food, small size—certain foods harmless &c. &c. organs affected and diseases—extent unknown. A certain degree of

<sup>1</sup> Evidently a memorandum that an example should be given.

<sup>2</sup> The importance of exposure to new conditions for several generations is insisted on in the *Origin*, Ed. i. p. 7, also p. 131. In the latter passage the author guards himself against the assumption that variations are “due to chance,” and speaks of “our ignorance of the cause of each particular variation.” These statements are not always remembered by his critics.

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variation (Müller's twins)<sup>1</sup> seems inevitable effect of process of reproduction. But more important is that simple (?) generation, especially under new conditions [when no crossing] (causes) infinite variation and not direct effect of external conditions, but only in as much as it affects the reproductive functions<sup>2</sup>. There seems to be no part (*beau idéal* of liver)<sup>3</sup> of body, internal or external, or mind or habits, or instincts which does not vary in some small degree and [often] some (?) to a great amount.

[All such] variations [being congenital] or those very slowly acquired of all kinds [decidedly evince a tendency to become hereditary], when not so become simple variety, when it does a race. Each<sup>4</sup> parent transmits its peculiarities, therefore if varieties allowed freely to cross, except by the *chance* of two characterized by same peculiarity happening to marry, such varieties will be constantly demolished<sup>5</sup>. All bisexual animals must cross, hermaphrodite plants do cross, it seems very possible that her-

<sup>1</sup> Cf. *Origin*, Ed. i. p. 10, vi. p. 9, "Young of the same litter, sometimes differ considerably from each other, though both the young and the parents, as Müller has remarked, have apparently been exposed to exactly the same conditions of life."

<sup>2</sup> This is paralleled by the conclusion in the *Origin*, Ed. i. p. 8, that "the most frequent cause of variability may be attributed to the male and female reproductive elements having been affected prior to the act of conception."

<sup>3</sup> The meaning seems to be that there must be some variability in the liver otherwise anatomists would not speak of the '*beau idéal*' of that organ.

<sup>4</sup> The position of the following passage is uncertain. "If individuals of two widely different varieties be allowed to cross, a third race will be formed—a most fertile source of the variation in domesticated animals. (In the *Origin*, Ed. i. p. 20 the author says that "the possibility of making distinct races by crossing has been greatly exaggerated.") If freely allowed, the characters of pure parents will be lost, number of races thus (illegible) but differences (?) besides the (illegible). But if varieties differing in very slight respects be allowed to cross, such small variation will be destroyed, at least to our senses,—a variation [clearly] just to be distinguished by long legs will have offspring not to be so distinguished. Free crossing great agent in producing uniformity in any breed. Introduce tendency to revert to parent form."

<sup>5</sup> The swamping effect of intercrossing is referred to in the *Origin*, Ed. i. p. 103, vi. p. 126.

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## MAN'S SELECTION

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maphrodite animals do cross,—conclusion strengthened: ill effects of breeding in and in, good effects of crossing possibly analogous to good effects of change in condition (?)<sup>1</sup>.

Therefore if in any country or district all animals of one species be allowed freely to cross, any small tendency in them to vary will be constantly counteracted. Secondly reversion to parent form—analogue of *vis medicatrix*<sup>2</sup>. But if man selects, then new races rapidly formed,—of late years systematically followed,—in most ancient times often practically followed<sup>3</sup>. By such selection make race-horse, dray-horse—one cow good for tallow, another for eating &c.—one plant's good lay (illegible) in leaves another in fruit &c. &c.: the same plant to supply his wants at different times of year. By former means animals become adapted, as a direct effect to a cause, to external conditions, as size of body to amount of food. By this latter means they may also be so adapted, but further they may be adapted to ends and pursuits, which by no possibility can affect growth, as existence of tallow-chandler cannot tend to make fat. In such selected races, if not removed to new conditions, and (if) preserved from all cross, after several generations become very true, like each other and not varying. But man<sup>4</sup> selects only (?) what is useful and curious—has bad judgment, is capricious,—grudges to destroy those that do not come up to his pattern,—has no

<sup>1</sup> A discussion on the intercrossing of hermaphrodites in relation to Knight's views occurs in the *Origin*, Ed. i. p. 96, vi. p. 119. The parallelism between crossing and changed conditions is briefly given in the *Origin*, Ed. i. p. 267, vi. p. 391, and was finally investigated in *The Effects of Cross and Self-Fertilisation in the Vegetable Kingdom*, 1876.

<sup>2</sup> There is an article on the *vis medicatrix* in Brougham's *Dissertations*, 1839, a copy of which is in the author's library.

<sup>3</sup> This is the classification of selection into methodical and unconscious given in the *Origin*, Ed. i. p. 33, vi. p. 38.

<sup>4</sup> This passage, and a similar discussion on the power of the Creator (p. 6), correspond to the comparison between the selective capacities of man and nature, in the *Origin*, Ed. i. p. 83, vi. p. 102.

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[knowledge] power of selecting according to internal variations,—can hardly keep his conditions uniform,—[cannot] does not select those best adapted to the conditions under which (the) form (?) lives, but those most useful to him. This might all be otherwise.

§ II. (ON VARIATION IN A STATE OF NATURE AND ON THE NATURAL MEANS OF SELECTION.)

Let us see how far above principles of variation apply to wild animals. Wild animals vary exceedingly little—yet they are known as individuals<sup>1</sup>. British Plants, in many genera number quite uncertain of varieties and species: in shells chiefly external conditions<sup>2</sup>. Primrose and cowslip. Wild animals from different [countries can be recognized]. Specific character gives some organs as varying. Variations analogous in kind, but less in degree with domesticated animals—chiefly external and less important parts.

Our experience would lead us to expect that any and every one of these organisms would vary if (the organism were) taken away (?) and placed under new conditions. Geology proclaims a constant round of change, bringing into play, by every possible (?) change of climate and the death of pre-existing inhabitants, endless variations of new conditions. These (?) generally very slow, doubtful though (illegible) how far the slowness (?) would produce tendency to vary. But Geolog(ists) show change in configuration which, together with the accidents of air and water and the means of transportal which every being possesses, must occasionally bring, rather suddenly, organism to new conditions and (?) expose it for several generations.

<sup>1</sup> i.e. they are individually distinguishable.

<sup>2</sup> See *Origin*, Ed. i. p. 133, vi. p. 165.

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Hence (?) we should expect every now and then a wild form to vary<sup>1</sup>; possibly this may be cause of some species varying more than others.

According to nature of new conditions, so we might expect all or majority of organisms born under them to vary in some definite way. Further we might expect that the mould in which they are cast would likewise vary in some small degree. But is there any means of selecting those offspring which vary in the same manner, crossing them and keeping their offspring separate and thus producing selected races: otherwise as the wild animals freely cross, so must such small heterogeneous varieties be constantly counter-balanced and lost, and a uniformity of character [kept up] preserved. The former variation as the direct and necessary effects of causes, which we can see can act on them, as size of body from amount of food, effect of certain kinds of food on certain parts of bodies &c. &c.; such new varieties may then become adapted to those external [natural] agencies which act on them. But can varieties be produced adapted to end, which cannot possibly influence their structure and which it is absurd to look (at) as effects of chance. Can varieties like some vars. of domesticated animals, like almost all wild species be produced adapted by exquisite means to prey on one animal or to escape from another,—or rather, as it puts out of question effects of intelligence and habits, can a plant become adapted to animals, as a plant which cannot be impregnated without agency of insect; or hooked seeds depending on animal's existence: woolly animals cannot have any direct effect on seeds of plant. This point which all theories about

<sup>1</sup> When the author wrote this sketch he seems not to have been so fully convinced of the general occurrence of variation in nature as he afterwards became. The above passage in the text possibly suggests that at this time he laid more stress on *sports* or *mutations* than was afterwards the case.

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climate adapting woodpecker<sup>1</sup> to crawl (?) up trees, (illegible) miseltoe, (sentence incomplete). But if every part of a plant or animal was to vary (illegible), and if a being infinitely more sagacious than man (not an omniscient creator) during thousands and thousands of years were to select all the variations which tended towards certain ends ([or were to produce causes (?) which tended to the same end]), for instance, if he foresaw a canine animal would be better off, owing to the country producing more hares, if he were longer legged and keener sight,—greyhound produced<sup>2</sup>. If he saw that aquatic (animal would need) skinned toes. If for some unknown cause he found it would advantage a plant, which (?) like most plants is occasionally visited by bees &c.: if that plant's seed were occasionally eaten by birds and were then carried on to rotten trees, he might select trees with fruit more agreeable to such birds as perched, to ensure their being carried to trees; if he perceived those birds more often dropped the seeds, he might well have selected a bird who would (illegible) rotten trees or [gradually select plants which (he) had proved to live on less and less rotten trees]. Who, seeing how plants vary in garden, what blind foolish man has done<sup>3</sup> in a few years, will deny an all-seeing being in thousands of years could effect (if the Creator chose to do so), either by his own direct foresight or by intermediate means,—which will represent (?) the creator of this universe. Seems usual means. Be it remembered I have nothing to say about life and mind and *all*

<sup>1</sup> The author may possibly have taken the case of the woodpecker from Buffon, *Histoire Nat. des Oiseaux*, T. vii. p. 3, 1780, where however it is treated from a different point of view. He uses it more than once, see for instance *Origin*, Ed. i. pp. 3, 60, 184, vi. pp. 3, 76, 220. The passage in the text corresponds with a discussion on the woodpecker and the mistletoe in *Origin*, Ed. i. p. 3, vi. p. 3.

<sup>2</sup> This illustration occurs in the *Origin*, Ed. i. pp. 90, 91, vi. pp. 110, 111.

<sup>3</sup> See *Origin*, Ed. i. p. 83, vi. p. 102, where the word *Creator* is replaced by *Nature*.

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forms descending from one common type<sup>1</sup>. I speak of the variation of the existing great divisions of the organised kingdom, how far I would go, hereafter to be seen.

Before considering whether (there) be any natural means of selection, and secondly (which forms the 2nd Part of this sketch) the far more important point whether the characters and relations of animated (things) are such as favour the idea of wild species being races (?) descended from a common stock, as the varieties of potato or dahlia or cattle having so descended, let us consider probable character of [selected races] wild varieties.

*Natural Selection.* De Candolle's war of nature,—seeing contented face of nature,—may be well at first doubted; we see it on borders of perpetual cold<sup>2</sup>. But considering the enormous geometrical power of increase in every organism and as (?) every country, in ordinary cases (countries) must be stocked to full extent, reflection will show that this is the case. Malthus on man,—in animals no moral [check] restraint (?)—they breed in time of year when provision most abundant, or season most favourable, every country has its seasons,—calculate robins—oscillating from years of destruction<sup>3</sup>. If proof were wanted let any singular change of climate (occur) here (?), how astoundingly some tribes (?) increase, also introduced animals<sup>4</sup>, the

<sup>1</sup> Note in the original. “Good place to introduce, saying reasons hereafter to be given, how far I extend theory, say to all mammalia—reasons growing weaker and weaker.”

<sup>2</sup> See *Origin*, Ed. i. pp. 62, 63, vi. p. 77, where similar reference is made to De Candolle; for Malthus see *Origin*, p. 5.

<sup>3</sup> This may possibly refer to the amount of destruction going on. See *Origin*, Ed. i. p. 68, vi. p. 84, where there is an estimate of a later date as to death-rate of birds in winter. “Calculate robins” probably refers to a calculation of the rate of increase of birds under favourable conditions.

<sup>4</sup> In the *Origin*, Ed. i. pp. 64, 65, vi. p. 80, he instances cattle and horses and certain plants in S. America and American species of plants in India, and further on, as unexpected effects of changed conditions, the enclosure of a heath, and the relation between the fertilisation of clover and the presence of cats (*Origin*, Ed. i. p. 74, vi. p. 91).

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pressure is always ready,—capacity of alpine plants to endure other climates,—think of endless seeds scattered abroad,—forests regaining their percentage<sup>1</sup>,—a thousand wedges<sup>2</sup> are being forced into the œconomy of nature. This requires much reflection; study Malthus and calculate rates of increase and remember the resistance,—only periodical.

The unavoidable effect of this (is) that many of every species are destroyed either in egg or [young or mature (the former state the more common)]. In the course of a thousand generations infinitesimally small differences must inevitably tell<sup>3</sup>; when unusually cold winter, or hot or dry summer comes, then out of the whole body of individuals of any species, if there be the smallest differences in their structure, habits, instincts [senses], health &c., (it) will on an average tell; as conditions change a rather larger proportion will be preserved: so if the chief check to increase falls on seeds or eggs, so will, in the course of 1000 generations or ten thousand, those seeds (like one with down to fly<sup>4</sup>) which fly furthest and get scattered most ultimately rear most plants, and such small differences tend to be hereditary like shades of expression in human countenance. So if one parent (?) fish deposits its egg in infinitesimally different circumstances, as in rather shallower or deeper water &c., it will then (?) tell.

Let hares<sup>5</sup> increase very slowly from change of climate affecting peculiar plants, and some other (illegible) rabbit decrease in same proportion [let this unsettle organisation of], a canine animal, who

<sup>1</sup> *Origin*, Ed. i. p. 74, vi. p. 91. "It has been observed that the trees now growing on...ancient Indian mounds...display the same beautiful diversity and proportion of kinds as in the surrounding virgin forests."

<sup>2</sup> The simile of the wedge occurs in the *Origin*, Ed. i. p. 67; it is deleted in Darwin's copy of the first edition: it does not occur in Ed. vi.

<sup>3</sup> In a rough summary at the close of the Essay, occur the words:—"Every creature lives by a struggle, smallest grain in balance must tell."

<sup>4</sup> Cf. *Origin*, Ed. i. p. 77, vi. p. 94.

<sup>5</sup> This is a repetition of what is given at p. 6.



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formerly derived its chief sustenance by springing on rabbits or running them by scent, must decrease too and might thus readily become exterminated. But if its form varied very slightly, the long legged fleet ones, during a thousand years being selected, and the less fleet rigidly destroyed must, if no law of nature be opposed to it, alter forms.

Remember how soon Bakewell on the same principle altered cattle and Western, sheep,—carefully avoiding a cross (pigeons) with any breed. We cannot suppose that one plant tends to vary in fruit and another in flower, and another in flower and foliage,—some have been selected for both fruit and flower: that one animal varies in its covering and another not,—another in its milk. Take any organism and ask what is it useful for and on that point it will be found to vary,—cabbages in their leaf,—corn in size (and) quality of grain, both in times of year,—kidney beans for young pod and cotton for envelope of seeds &c. &c.: dogs in intellect, courage, fleetness and smell (?): pigeons in peculiarities approaching to monsters. This requires consideration,—should be introduced in first chapter if it holds, I believe it does. It is hypothetical at best<sup>1</sup>.

Nature's variation far less, but such selection far more rigid and scrutinising. Man's races not [even so well] only not better adapted to conditions than other races, but often not (?) one race adapted to its conditions, as man keeps and propagates some alpine plants in garden. Nature lets (an) animal live, till on actual proof it is found less able to do the required work to serve the desired end, man judges solely by his eye, and knows not whether

<sup>1</sup> Compare *Origin*, Ed. i. p. 41, vi. p. 47. "I have seen it gravely remarked, that it was most fortunate that the strawberry began to vary just when gardeners began to attend closely to this plant. No doubt the strawberry had always varied since it was cultivated, but the slight varieties had been neglected."

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nerves, muscles, arteries, are developed in proportion to the change of external form.

Besides selection by death, in bisexual animals (illegible) the selection in time of fullest vigour, namely struggle of males; even in animals which pair there seems a surplus (?) and a battle, possibly as in man more males produced than females, struggle of war or charms<sup>1</sup>. Hence that male which at that time is in fullest vigour, or best armed with arms or ornaments of its species, will gain in hundreds of generations some small advantage and transmit such characters to its offspring. So in female rearing its young, the most vigorous and skilful and industrious, (whose) instincts (are) best developed, will rear more young, probably possessing her good qualities, and a greater number will thus (be) prepared for the struggle of nature. Compared to man using a male alone of good breed. This latter section only of limited application, applies to variation of [specific] sexual characters. Introduce here contrast with Lamarck — absurdity of habit, or chance ?? or external conditions, making a woodpecker adapted to tree<sup>2</sup>.

Before considering difficulties of theory of selection let us consider character of the races produced, as now explained, by nature. Conditions have varied slowly and the organisms best adapted in their whole course of life to the changed conditions have always been selected,—man selects small dog and afterwards gives it profusion of food,—selects a long-backed and short-legged breed and gives it no particular exercise to suit this function &c. &c. In ordinary cases nature has not allowed her race to

<sup>1</sup> Here we have the two types of sexual selection discussed in the *Origin*, Ed. i. pp. 88 et seq., vi. pp. 108 et seq.

<sup>2</sup> It is not obvious why the author objects to “chance” or “external conditions making a woodpecker.” He allows that variation is ultimately referable to conditions and that the nature of the connexion is unknown, i.e. that the result is fortuitous. It is not clear in the original to how much of the passage the two ? refer.