

# Elimination and Selection.

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THOSE who have read the recently-published "Life of Charles Darwin" may remember a footnote in which Mr. A. R. Wallace criticizes the phrase "Natural Selection." "The term 'Survival of the Fittest,'" he says, "is the plain expression of the fact; 'Natural Selection' is a metaphorical expression of it, and to a certain degree indirect and incorrect, since Nature does not so much select special varieties as exterminate the most unfavourable ones."\* Mr. Darwin, while admitting with his wonted candour the force of this criticism, urges in support of the use of his own phrase, first, that it can be employed as a substantive governing a verb; secondly, that it serves to connect artificial and natural selection; and thirdly,† that its meaning is *not* obvious, and that this leads men to think the matter out for themselves.

I propose here briefly to consider Mr. Wallace's criticism; to suggest provisionally the use of the phrase, "Natural Elimination," which *can* be employed as a substantive "governing a verb"; and to indicate the advantages which

\* "Life," vol. iii., p. 46.

† Vol. ii., p. 278.

would attend the use of such a term, not the least of which is, that it serves to distinguish between artificial selection and "natural selection."

Mr. Herbert Spencer's term, "Survival of the Fittest," says Mr. Wallace, is the plain expression of the fact; "Natural Selection" is a metaphorical expression of it. Yes; but in the first place, Mr. Spencer's phrase gives no inkling of the process by which such survival is brought about; and, in the second place, it is questionable whether any phrase, which does so indicate the process, can escape the charge of being in some degree metaphorical. The sting of Mr. Wallace's criticism, therefore, would appear to lie (appropriately) in the tail, where he points out that Nature does not so much select special varieties as exterminate the most unfavourable ones. This seems to me a valid criticism; one which Mr. Darwin does not sufficiently meet; and one which still holds good. I would, however, venture to suggest that the word "eliminate," though somewhat metaphorical, is more satisfactory than Wallace's word, "exterminate"; and I further venture to suggest that the use of the phrase, *Natural Elimination*, would emphasize the fact that, whereas in artificial selection it is almost invariably the fittest which are chosen out for survival, it is not so under Nature; the "survival of the fittest" under Nature being in the main the net result of a slow and gradual process of the elimination of the unfit. The well-adapted are not selected; but the ill-adapted are rejected; or rather, the failures are just inevitably eliminated.

I do not mean for one moment to hint that Mr. Darwin failed to recognise this fact. But I do think he failed to give it adequate expression. I do think that if he had employed the term "Selection" for the choosing out the more fit, and "Elimination" for weeding out the less fit,

his meaning in many cases would have been made more clear. "The principle of selection," he says, "may be conveniently divided into three kinds: *Methodical Selection* is that which guides a man who systematically endeavours to modify a breed according to some pre-determined standard. *Unconscious Selection* is that which follows from men naturally preserving the most valued, and destroying the less valued individuals, without any thought of altering the breed. Lastly, we have *Natural Selection*, which implies that the individuals which are best fitted for the complex and in the course of ages changing conditions to which they are exposed, generally survive and procreate their kind."\* Here the transition from selection to elimination is effected under the head of unconscious selection, where the breeder is not intentionally modifying the strain, but is merely desirous of keeping up the standard. And this he effects in one or both of two ways: either by selecting his best cattle, or dogs, or other domestic animals to breed from, or by weeding out the unsatisfactory individuals. The end in view is the same, but the processes employed are sufficiently distinct; selection being applied to one end of the scale, elimination at the other.

Now in "natural selection" (so-called), the standard is maintained mainly (but not entirely) by weeding out the failures; by elimination of the unfit. "Natural Rejection" would therefore have been a more appropriate phrase; but "Natural Elimination" seems to me more satisfactory and less metaphorical.

It is just possible that some one may say: If nothing more takes place than the elimination of the unfit, where is the possibility of advance? You may keep up the stand-

\* "Animals and Plants," 1st ed., vol. ii., p. 193.

ard, but progress is surely impossible. Such an objection would, however, imply a forgetfulness of the facts of variation. Variation is constantly taking place; and the variations may be favourable, or unfavourable, or neutral. Under selection, the favourable variations will be chosen out; the unfavourable and the neutral may go. Under elimination, the unfavourable disappear; the favourable *and the neutral* remain. By how much the favourable variations are in excess, by so much will the race tend to advance. I see no reason why neutral variations should be eliminated, except in so far as,—in the keen struggle for existence,—they become relatively unfavourable.\*

Too much stress is, I think, laid upon utility. Mr. Wallace himself contends "that none of the definite facts of organic nature, no special organ, no characteristic form or marking, no peculiarity of instinct or of habit, no relations between species or between groups of species, can exist, but which must now be or once have been *useful* to the individuals or the races which possess them." † And Mr. Romanes, in his valuable and suggestive paper on Physiological Selection (physiological *isolation* would better express its scope), brings forward the inutility of specific characters as one of the three "cardinal difficulties in the way of natural selection, considered as a theory of the origin of species." "The features," he says, "which serve to distinguish allied species, are frequently, if not usually, of a kind with which natural selection can have had nothing whatever to do; for distinctions of specific value frequently have reference to structures which are without any utilitarian significance." ‡

But why should neutral variations,—variations, that is to

\* Cf. "Origin of Species," 6th ed., p. 63.

† "Natural Selection," p. 47.

‡ *Journ. Lin. Soc., Zool.*, vol. xix., p. 338.

say, which are neither useful nor harmful,—be eliminated under Nature? If they escape, through isolation or otherwise, that swamping by intercrossing by which *all* variations are liable to be submerged, why should they be weeded out? I am inclined to think that the use of the term “Natural Selection,” implying some natural tendency for the fittest individuals and the most useful structures to be chosen out for preservation, has led to too much stress being laid on the necessary utility of structures and specific features. And I venture to think that the use of some such term as “Natural Elimination,” implying the natural tendency of the unfavourable and deleterious variations to be weeded out, would have saved us from some perplexity in this matter. Undoubtedly, in the long run, useful variations will tend more and more to preponderate, since the longer and keener the struggle the greater and more inevitable the tendency of neutral variations to become relatively unfavourable. And this is exactly what we do find. For, as Mr. Romanes remarks, in continuation of the passage quoted above, “It is not until we advance to the more important distinctions between genera, families, and orders that we begin to find, on any large or general scale, unmistakable evidence of utilitarian meaning.”

Not only does the use of the phrase “Natural Elimination” save us from misconceptions of this nature; it also serves to connect the natural process with that struggle for existence out of which it arises. The struggle for existence is the reaction of the organic world called forth by the action of natural elimination. Organisms are tending to increase in geometrical ratio. There is not room for the myriads born. The tendency to increase is therefore held in check by elimination involving the struggle for existence

"This term," says Mr. Darwin, "I use in a large and metaphorical sense," which he then proceeds to explain. It would seem, in the suggested phraseology, to be the result of a three-fold process of elimination. First, elimination by the direct action of surrounding conditions; secondly, elimination by enemies; and thirdly, elimination by competition.\*

As an example of the first kind of elimination, Darwin tells us that in the winter of 1854-5, four-fifths of the birds in his grounds perished from the severity of the weather. My colleague, Mr. Munro Smith, informs me that, in cultivating microbes, certain forms, such as *Bacillus violaceus* and *Micrococcus prodigiosus*, remain in the field during cold weather when other less hardy microbes have perished. At the edge of a coral reef, minute, active, free-swimming coral embryos are set free in immense numbers. Presently they settle down for life. Some settle on a muddy bottom, others on a cold bottom, others at too great a depth. All these are eliminated. Only the few who chance to take up a favourable position are preserved. The parable of the Sower gives us another case in point. Examples could be multiplied indefinitely. I imagine that during the oncoming of the glacial epoch there was much pitiless elimination of this order. Among civilized human folk this form of elimination is only seen in military campaigns, in Arctic expeditions, and in arduous travels. But in early times and among savages it must be a more important factor.

Elimination by enemies scarcely needs exemplification. Battle within battle must, throughout nature, as Mr. Darwin says, be continually recurring with varying success. The stronger devour the weaker, and wage war with each other

\* Cf. "Origin of Species," pp. 50 and 53.

over the prey. Under this head may be taken the phenomena of parasitism. Neither cattle, nor horses, nor dogs have ever run wild in Paraguay, owing to the insidious attacks of a certain fly, which lays her eggs in the bodies of the newly born. There is scarcely a form of life so harmless or so retiring as not to be liable to the attacks of enemies from without or from within. Among human folk, moreover, elimination by enemies is not wholly unknown; and in this connection it is a sad reflection, as Sir W. R. Grove has well said, that man is almost the only animal that fights, not for food, or means of life, or of perpetuating its race, but from motives of merest vanity, ambition, or passion.

Elimination by competition is by far the most important. As Mr. Darwin so well points out, the competition is keenest between members of the same group and among individuals of the same species, or between different groups or different species which have, so to speak, similar aims in life. Alternations of hard times and good times are here effective, and may convert competition into war. During the Exhibition at South Kensington there were good times for rats. But when the show was over, there followed times that were cruelly hard. The keenest competition for the scanty food arose; and the poor creatures were forced to prey upon each other. "Their cravings for food," we read in *Nature*, "culminated in a fierce onslaught upon one another, which was evidenced by the piteous cries of those being devoured. Their method of seizing their victims is to suddenly make a raid upon one weaker or smaller than themselves, and after overpowering it by numbers, to tear it in pieces."

During the upheavals and depressions and the marked climatic changes of geological times, this alternation must have occurred again and again. Not only would there be

an actual expansion and contraction of the life-area, as when a continent was rising or sinking, but there would be a virtual expansion and contraction as the power of supporting life in the area was, by changes of climate or other causes, increased or diminished. During good times, varieties which would otherwise be unable to hold their own might arise, and have time to establish themselves. During bad times, all who were then found unfit would be eliminated.

That elimination by competition obtains among human folk, needs, alas! no illustration. Here, too, there is an alternation of good times and hard times, with effects sufficiently marked. The introduction of ostrich-farming in South Africa affords a case in point. This produced good times for the farmers. Whereupon there resulted variation in two directions. Some devoted increased profits to improvements on their farms, to irrigation works which could not before be afforded, and so forth. For others, increased income meant increased expenditure, and an easier, if not more luxurious, mode of life. Then came hard times. Others, in Africa and elsewhere, learnt the secret of ostrich-farming. Competition brought down prices, and elimination set in—of which variety need hardly be stated.

Such, then, are the modes of elimination. Observe that it is a differentiating process. As Darwin says: "It may be well here to remark, that with all beings there must be much fortuitous destruction, which can have little or no influence on the course of natural selection."\* The ant-bear swallowing a tongue-load of ants; balænoptera engulfing whole shoals of herrings; the Greenland whale swallowing thousands of fry; the bear or the badger destroying

\* "Origin of Species," p. 68.

whole nests of bees—these are examples of wholesale destruction, not of the elimination of the unfit.

Let us now turn to cases of selection, properly so called, where Nature is in some way working at the other end of the scale; where her method is not the elimination of the unfit, but the selection of the fit. Such a case may be found on Darwin's principles in brightly-coloured flowers and fruits. "Flowers," he says, "rank amongst the most beautiful productions of nature; but they have been rendered conspicuous in contrast with the green leaves, and, in consequence, at the same time beautiful, so that they may be easily observed by insects. I have come to this conclusion from finding it an invariable rule, that when a flower is fertilized by the wind, it never has a gaily coloured corolla. Several plants habitually produce two kinds of flowers; one kind open and coloured, so as to attract insects; the other closed, not coloured, destitute of nectar, and never visited by insects. Hence we may conclude that, if insects had not been developed on the face of the earth, our plants would not have been decked with beautiful flowers, but would have produced only such poor flowers as we see on our fir, oak, nut, and ash trees, on grasses, spinach, docks, and nettles, which are all fertilized through the agency of the wind. A similar line of argument holds good with fruits; that a ripe strawberry or cherry is as pleasing to the eye as to the palate,—that the gaily coloured fruit of the spindle-wood tree, and the scarlet berries of the holly, are beautiful objects,—will be admitted by every one. But this beauty serves merely as a guide to birds and beasts, in order that the fruit may be devoured and manured seeds disseminated: I infer that this is the case from having as yet found no exception to the rule, that seeds are always thus disseminated when embedded within a fruit of any

kind (that is, within a fleshy or pulpy envelope), if it be coloured of any brilliant tint, or rendered conspicuous by being white or black." \*

Here we have a case of the converse of elimination, a case of genuine selection under nature. But even here the process of elimination also comes into play, for the visitations of flowers by insects involves cross-fertilization. The flowers of two distinct individuals of the same species of plants in this manner fertilize each other; and the act of crossing, as Mr. Darwin so exquisitely proved, gives rise to vigorous seedlings, which consequently would have the best chance of flourishing and surviving—would best resist elimination by competition. So that we here have the double process at work; the fairest flowers being selected by insects, and those plants which failed to produce such flowers being eliminated as the relatively unfit.

If we turn to the phenomena of what Mr. Darwin termed sexual selection, we find both selection and elimination brought into play. By the law of battle, the weaker and less courageous males are eliminated so far as the continuation of their kind is concerned. By the individual choice of the females (I may not here say the fairer sex), the finer, bolder, handsomer, and more tuneful wooers are selected.

Let us again hear the voice of Mr. Darwin himself. "Most male birds," he says, "are highly pugnacious during the breeding season, and some possess weapons especially adapted for fighting with their rivals. But the most pugnacious and the best-armed males rarely or never depend for success solely on their power to drive away or kill their rivals, but have special means for charming the female. With some it is the power of song, or of emitting strange

\* "Origin of Species," p. 161.

cries, or of producing instrumental music; and the males in consequence differ from the females in their vocal organs or in the structure of certain feathers. From the curiously diversified means for producing various sounds, we gain a high idea of the importance of this means of courtship. Many birds endeavour to charm the females by love-dances or antics, performed on the ground or in the air, and sometimes at prepared places. But ornaments of many kinds, the most brilliant tints, combs and wattles, beautiful plumes, elongated feathers, top-knots, and so forth, are by far the commonest means. In some cases, mere novelty appears to have acted as a charm. The ornaments of the males must be highly important to them, for they have been acquired in not a few cases at the cost of increased danger from enemies, and even at some loss of power in fighting with their rivals.\* . . . What, then, are we to conclude from these facts and considerations? Does the male parade his charms with so much pomp and rivalry for no purpose? Are we not justified in believing that the female exerts a choice, and that she receives the addresses of the male who pleases her most?" †

Here again, then, we have the combined action of elimination and selection. And now we may note that selection involves intelligence; or, since it may be objected that selection is in some cases instinctive, let us rather say, involves the mind-element, or the element of consciousness. Hence it is that when we come to consider the evolution of human folk, the principle of elimination is so profoundly modified by the principle of selection. Not only are the weaker eliminated by the inexorable pressure of competition, but we select the more fortunate individuals and heap

\* "Descent of Man," summary of chap. xvi., pt. ii.

† *Ibid.* chap. xiv.

upon them our favours. This enables us also to soften the rigour of the blinder law; to let the full stress of competitive elimination fall upon the worthless, the idle, the profligate, and the vicious; but to lighten its incidence on the deserving but unfortunate.

Too little importance has, perhaps, been attached of late years to the mental element in evolution. In Lamarckism it took a foremost place. "Every considerable alteration in the local circumstances in which each race of animals exists," wrote Lamarck, as summarized by Lyell, "causes a change in their wants; and these new wants excite them to new actions and habits. These actions require the more frequent employment of some parts before but slightly exercised, and their greater development follows as a consequence of this more frequent use. Other organs no longer in use are impoverished and diminished in size, nay, are sometimes entirely annihilated, while in their place new parts are insensibly produced for the discharge of new functions." \* In the reaction against Lamarckism, the mental element fell into the background. But those naturalists who have kept abreast of philosophy are more and more coming round to the view that mind and body are indissolubly connected—that the mind does not act *ab extra*, but is an integral and essential part of the organic whole. In two ways is the mind-element operative; in enabling the intelligent organism to avoid elimination, and in furthering the process of selection.

I do not mean to imply that the mind-element can originate anything, except in reaction to surrounding conditions, inorganic and organic. We are still quite in the dark about origins. Elimination originates nothing; it merely crowds out failures. Selection originates nothing;

\* Lyell, "Principles," 11th ed., vol. ii., p. 253.

the favourable varieties must be there ere they can be chosen out for survival. When Darwin speaks of the eye as *formed by* natural selection, he uses, somewhat unguardedly, the language of metaphor. We are thrown back upon variation, bodily and mental, as the origin. But how originates this variation? In response to surrounding conditions. True; but how?

Starting, however, with variations, somehow conditioned and in some way caused, it has been my object to show that they are, under Nature, subjected to a double process—a process of elimination—weeding out the unfit, and a process of selection—choosing out the more fit. Of these, elimination is the more universal, selection only coming into play when intelligence has definitely appeared on the scene of life. Of the three kinds of variations—favourable, neutral, and unfavourable, elimination only gets rid of the unfavourable, leaving both the favourable and the neutral in possession of the field, except in those cases where severe and long-continued competition has rendered even the neutral variations relatively unfavourable. Selection, on the other hand, picks out only the favourable variations; so that under selection alone, the occurrence of useless structures or features would be anomalous. Both principles have been operative under nature; and both are included under Mr. Darwin's terms, "Natural Selection" and "Sexual Selection."

In conclusion, let me say that I am not so foolish or so vain as to suppose that what I have here written and elsewhere taught is likely to effect a revolution in biological nomenclature. Whether the occasional use of the term "Natural Elimination," alongside of and in subservience to Natural Selection, would be of service to those who are students and teachers of Evolution doctrines, I must leave others to judge.