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THE EPISTEMOLOGICAL STATUS OF NATURAL SELECTION

A RECONSIDERATION

Gregory Alan PESELY

PERHAPS one of the most controversial and monumental theories in the history of science was presented to the London Linnean Society on July 1, 1858. While the theory of natural selection has been articulated on numerous occasions from the ancient Greeks to the modern evolutionary biologists, these versions, nevertheless, are invariably compared to — and measured by — the hypothesis that was formulated by Charles Darwin over an hundred and twenty years ago.

Darwin's greatness was essentially due to his insights into the nature of natural selection; to his having possessed a firm grasp of the universal application of the principle throughout the biological world; to be able to support the hypothesis with appropiate and quite convincing examples from biology; and to his having successfully presented a theory that not only revolutionized the thinking of the entire scientific community, but that incorporated modifications necessary to silence most of the objections raised during the turbulent history of the doctrine of natural selection.

Most evolutionary biologists agree that the existence of the principle of natural selection has been definitely proven;[1] however, although most evolutionary biologists are satisfied with the experimental evidence establishing the existence of natural selection, this does not in any way terminate our investigation of the powers, ramifications and properties of natural selection. Universal acceptance of the theory does not constitute an actual proof for its existence or its ability to account for the biological phenomena.[2] Without a profound understanding of the principle with all the accompanying nuances, ramifications and difficulties, our capacity for acquiring

1. Cf. J.B.S. HALDANE, *The Causes of Evolution*, Ithica, Cornell Uni. Press, 1966, p. 96; P.M. SHEPPARD, *Natural Selection and Heredity*, London, Hutchison Uni. Library, 1958, p. 228; and ERNST MAYR, *Evolution and the Diversity of Life*, Cambridge, Belknap Press of Harvard Uni. Press, 1967, p. 114.

2. Cf. ERNST MAYR, *Animal, Species and Evolution*, Cambridge, The Belknap Press of Harvard Uni. Press, 1963, p. 7; cf. also Max LERNER, "The Concept of Natural Selection", quoted by MAYR in *Evolution and the Diversity of Life*, p. 315.

new knowledge regarding the nature of such an important principle would be greatly diminished. We must carefully re-examine the doctrine of natural selection if we ever hope to fully appreciate the extraordinary subtlety of this most important biological principle; for much of it has been handed down from Darwin without serious reflection or re-examination.[3]

Since this paper is a philosophical consideration of the doctrine of natural selection, we must examine the various methodological problems that are connected with its explanation. Whereas it is the task of the biologist to discover and articulate the appropriate phenomena, it is for the natural philosopher to consider whether the actual formulation accounts for the phenomena; whether the principles are too vague, whether the scientist has proceeded correctly, and whether the conclusions follow from the given premisses. Thus, it is the duty of the philosopher to point out any logical inconsistencies, contradictions, or sophistries; to judge the strength and the character of the arguments; to warn of weaknesses or difficulties; and to see if the explanations sufficiently deal with the evidence presented by the biologist.

Natural selection cannot be justified by the principle of evolutionary biology, for it is itself a principle of evolutionary biology. There is nothing prior to this principle in biology that can justify it; but obviously we cannot use it to justify itself without begging the question. Nor can the principle be demonstratively proved by those things which follow upon it, for facts, however numerous, can never prove conclusively the truth of a particular theory. Although it is possible to show that a theory falls short of what it is trying to explain, or is simply false, when it does not correspond with the given evidence, it is not possible to show conclusively that a theory is true — or even possible — when it corresponds to the evidence, for a true conclusion can be derived from false premisses.

Yet, insofar as the hypothesis predicts and interprets the evidence, it can be judged by its consequences. If the predictions are accurate and the interpretation of the phenomena is confirmed through experience and careful experimentation, then that which follows will support the hypothesis under investigation. These confirmations, however, can only give more credibility to the hypothesis; they do not demonstratively prove the hypothesis in the absolute sense. On the other hand, if the hypothesis is riddled with inconsistencies and contradictions, and can neither account for the phenomena nor accurately predict the outcome of certain events, the hypothesis is invalidated by that which follows. For these reasons, a true scientific hypothesis must be sufficiently determinate in order to be at least susceptible of being disproved, else we settle for a pseudo-religion instead of scientific knowledge.

Since the theory of natural selection is proposed as a hypothesis which is capable of accounting for the biological phenomena, it must be judged according to its consistency and its ability to explain why things are as they are. Hence, this biological hypothesis must be judged, whether negatively of affirmatively, by that which follows.[4] Evolutionary biology should not be the modern equivalent of the nebulous

3. Cf. George GAYLORD SIMPSON, *Major Features of Evolution*, New York, Columbia Uni. Press, 1953, p. 132.

4. Cf. Sir Karl POPPER, *Conjectures and Refutations*, London, Routledge and Kegan Paul, 1963, pp. 36–38.

replies from the Oracle of Delphi that could fit any situation without difficulty. The actual arguments, difficulties and ramifications must be carefully examined. Yet, despite the raging controversies and the constant discussions concerning the principle of natural selection for more than six score and two years, few have seriously examined the problem formally, or to any depth, in order to determine whether the principle is fundamentally sound or not.

Moreover, our thinking tends to be culture-bound and riddled with certain intellectual blindspots peculiar to our age. We are inclined to be overly pre-occupied with certain problems and seem to favor certain solutions. Ignorant of our lack of experience and understanding, we tend to dogmatize, giving more credence to certain arguments than are their due. Hence, even though we are unable to immediately resolve many of the difficulties, we should at least be aware of them, as well as our own limitations — if we are to proceed properly.

Due to the limited scope of this paper, it will be necessary to restrict this enterprise to a general consideration of the major difficulties with the Darwinian and neo-Darwinian principle of natural selection. Still, a general treatment of the problem will provide us not only with a better understanding of evolutionary biology, but a good framework that would stimulate and guide future discussions on the subject as well.

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The first premiss in Charles Darwin's argument for natural selection, namely the principle that every living being is trying to multiply in a geometrical ratio seems to be more of a weakly supported assumption than a brilliant observation of nature.

Darwin borrowed this premiss from the highly influential British economist and sociologist, Thomas Robert Malthus, whose basic assertion was that whereas the human population had a tendency to increase in a geometrical ratio, man's ability to sustain himself was only able to increase itself arithmetically. Darwin extended this principle to the entire biosphere.

Even presuming that this principle is justly applied to human populations, it is not immediately evident that it is justly applied elsewhere also. Every science has its own appropriate questions, arguments, and replies.[5] If, therefore, we try to extend a principle such as this, we ought to do so not gratuitously, but on the grounds of some justification. Darwin himself warns us of this: "analogy", he says, "may be a very deceitful guide."[6] Yet, despite this warning, neither Darwin himself nor his disciplines offer any explanation or justification for the application of his crucial principle to the entire biosphere.

There are multitudes of examples which illustrate the necessity for caution in extrapolating. The size of an adult human being might be sought by extrapolating the

5. S. Thomas AQUINAS, *In Aristotelis Libros Peri Hermeneias et Posteriorum Analyticorum Expositio*, Turin, Marietti, 1955, lecture 21, n. 178.

6. Charles DARWIN, *The Origin of Species*, New York, Modern Library, 1969, p. 370.

growth of a young child. But it is evident that one who extrapolates thus must account for the drastic reduction of the rate of growth of a man as he approaches maturity; failure to do so might obviously lead to absurd conclusions. We must take care, then, lest our extrapolations in biology become mere mental constructs of no value. If they are to lead to a more perfect understanding of natural things, they must be grounded firmly in the experiences of those natural things themselves. We might have sufficient data which reveal that Nature produces offspring at a fantastic rate; nevertheless, we must justify our extrapolation or assumption that Nature actually intends to increase at a geometrical rate,[7] and not that she merely intends to only maintain the present population. Hitherto such justification has not been presented. How, then is it to be shown that Nature intends to have the population increase exponentially? Our immediate experience of Nature does not completely conform to the supposedly universal character of this assumption. Some creatures, such as oysters and octopuses, are known to spawn a prodigious number of offspring; but there are others that produce very few young in their entire life, even under the best of conditions, such as it the case with bears, lions, whales, and elephants. Yet, according to Darwin's predictions, the population should always increase in overwhelming numbers whenever there is the slightest reduction of the checks.[8] Hence, those creatures with few or no selection checks should produce far more than those animals and plants with many checks or restraints.[9] The fact, therefore, that higher animals continue to generate only a few offspring seems to indicate that the principle in question, namely, that all creatures increase exponentially, is at best not very universal, and at worse, simply false.

Furthermore, one cannot propose as the reason why the higher animals do not try to produce according to a geometrical ratio, that the land would not be able to support their great numbers. For this would be positing some sort of foresight that would reject an immediate and real advantage in favor of a possible advantage in the distant future, an assumption which is most contrary to the doctrine of natural selection. It is moreover, begging the question.

Why must one attribute Nature's abundant production of seed and offspring to an attempt to increase geometrically? Our experience of Nature seems to indicate that she is merely attempting to replenish the present generation, nothing more. If a man makes eleven porcelain cups in order to replace his old set of ten, knowing that one cup normally breaks before he completes the set, could the artisan be justifiably accused of trying to increase the number of pieces in his porcelain set by any ratio? If not, how can striving be imputed to Nature if and when she produces more than will

7. Professor Huxley tries to argue in his work, *Evolution in Action*, that the true generative potential is never obtained, even under the most perfect conditions. Hence, he has extrapolated to something that could never be confirmed in Nature. Professor Dobzhansky, on the other hand, admits that Nature's generative potential rarely could be verified in reality. (Cf. his *Evolution, Genetics and Man*, New York, John Wiley and Sons, inc., 1955, p. 111.) Either way, evolutionary biologists are holding a rather tenuous position.

8. Cf. Charles DARWIN, "Linnean Society Papers" which are found in Philip APPLEMAN'S *Darwin*, New York, W.W. Norton & Co. Inc., 1970, p. 84.

9. Nor can one argue that the selectional checks do in fact exist, despite the lack of evidence, without making a *petitio principii.*

finally survive? Due to the many highly contingent circumstances, Nature needs to produce a great number of individuals in order to insure the success of the few, especially in the lower orders of the animal and plant kingdoms. Perhaps we are scandalized by the great wastes necessary to successfully maintain a stable population; nevertheless, we may never start positing foreign intentions or goals, no matter how desirable, without first offering some determinate evidence or proof.

Some evolutionary biologists, such as Dobzhansky, Mayr and Huxley, try to justify Darwin's first premiss by pointing out the great increase in population that follows a sudden and dramatic reduction in numbers or which follows as a result of a migration to a new territory. However, this must be seen as an exception — which can never adequately explain the rule — and it could just as easily be used to defend the position that Nature intends to quickly establish, or in some cases, re-establish, the population in its new environment. This action might be necessary, especially if the ecological balance is dependent on immediately having a well-developed, but stable, population.

One must remember that it is not sufficient, nor scientific, to examine biological entities in isolation, ignoring the harmony and interplay between their neighbors, predators, food supply and environment, just as one cannot scientifically investigate the motion of a body on earth without taking into consideration the gravitational forces, the presence of nearby bodies, friction, air resistance, etc. Likewise, in order to determine the true generative potential of a deer, one must include all the various factors and consider the degree to which each factor has an impact on the deer's life. Each science must consider all the factors which pertain to the entity under consideration and it must consider them in their proper context. One cannot treat the data out of context, nor extrapolate in such a fashion that the final product is unrecognizable in reality.

Moreover, if one tries to defend the validity of the first premiss by arguing that, since there is a struggle amongst the individuals there must be too many offspring being produced, he has again begged the question. For Darwin's assumption that there is competition amongst the individuals is derived from the first two premisses, namely, that there is a universal geometrical increase in the number of offspring and that the number of adults and the number of species both remain constant.[10] Furthermore, if only the second premiss of the argument is valid, one must conclude that there is no universal struggle for existence, literally or metaphorically understood. A major element in the argument for natural selection would be then rendered useless.

The assumption[11] derived from Darwin's first observation of Nature may indeed be true, but the proofs offered, at least as of yet, are not adequate to sufficiently establish Darwin's first premiss.

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10. The first two premisses of Darwin's argument for natural selection, as found in his work, *The Origin of Species* are as follows: First, all organisms tend to increase so rapidly that the entire earth could not support the progeny of a single pair. (Cf. p. 52.) Second, despite this tendency to increase, the average number of individuals and species remains relatively constant. (Cf. p. 59.)

11. The first premiss of Darwin's argument, i.e. is an assumption that Nature is trying to increase in a geometrical ratio, derived from his first observation of Nature — there are instances where the

"Survival" has the connotation of a struggle for continued existence or grappling with an extremely difficult situation; these things are easily verified in our internal or external experience. Our first notion of struggle is in dealing with a hard examination, completing the last lap of a heated race, or going against the wind and sleet in a raging blizzard. Still, it is rather easy to extend the notion of struggle in order to include the cases where two hungry dogs are fighting over the same piece of meat, a salmon is swimming against the great rapids on his return to the spawning grounds, and the lion is struggling in the hunter's net. Darwin, however, wants to extend the notion further in order to include all organisms and all aspects of life. Hence, the insignificant pollen in the lowly wild-flowers and the towering sequoia trees can now be included in the universal biological struggle, although not in the same way that was first observed in man and the higher animals. Supposedly, one must struggle because of the great competition — there is not enough food, water, mates, and possible places in which to raise one's offspring. The outcome of the competition will be determined by the immediate advantages that the organism possesses over its neighbors.

What is the product of the competition? Is it fitness? If so, what is meant by being "fit"? Is it being healthy, alert, strong, full of vigor, and capable of handing the daily problems encountered in living in this particular environment and around these competitors? These characteristics do not result from the actual struggle; rather, they enable the organism to have the ability to survive and reproduce. For these characteristics must be naturally produced or developed long before the actual struggle begins.

While struggle is first and most properly said of man, one can enlarge the notion to include actions within the animal kingdom, and even in the plant kingdom. Some evolutionary biologists, however, seem to want to extend the notion even further than it was done above.

For Professor Huxley, the struggle for existence means, nothing more than that a part of each generation will die before it can reproduce.[12] "Struggle" here no longer suggests combat or competition between members or against the environment; rather, it only means that something will not live long enough. This is not a new revelation or insight, for the platitude was already old in Homer's time.

This different interpretation of Darwin seems to gravely undermine the actual impact of the first three premisses,[13] and ultimately, the entire argument, for natural

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parents generate great numbers of offspring. However, the assumption should not be confused with the observation. The observation is merely verified by our senses; the assumption needs some sort of justification other than the mere annunciation thereof.

12. Cf. Julian HUXLEY, *Evolution in Action*, New York, Harpers and Brothers, 1942, p. 34.

13. Namely, (1) that there is a universal tendency to increase geometrically; but that, (2) despite the tendency to increase, the average number of individuals and species remains relatively constant; and, as a result, (3) there is a universal competition amongst all individuals and species in order to survive. (At this point, one should remark that the third premiss is not an observation of Nature, but a conclusion of the first two premisses. According to the doctrine, there must necessarily be a struggle in order to survive.)

selection. For natural selection is no longer viewed as the superior entity being selected over the inferior entity, or the adapted being preferred to the unadapted. It merely means that some organisms will never reach sexual maturity. The ramifications of this interpretation are far more serious than one immediately suspects. Instead of giving us hypotheses that can explain the mechanism of biological change — that can explain in other words why things are the way they are in Nature, Huxley has reduced an explanation of the biological phenomena in terms of actual causes to a mere description or statement of life and its unfortunate short-comings. Huxley has relinquished his scientific mission of discovering sound biological explanations for trite observations.

Moreover, if individuals of a certain group reproduce at a greater rate than their neighbors, the first group will eventually outnumber and thereby eliminate the rest from the stock or gene pool. Once again, it does not seem that the notion of struggle, literal or metaphorical, is essential to natural selection.

Furthermore, it seems strange to consider survival, as most neo-Darwinians would have it, in terms of how long one's genes persist in the gene pool, especially if natural selection operates only in the here and now. If one's genetic contribution is abruptly terminated a thousand, or even a couple million, years from now, how will this future possibility alter or affect the individual's struggle in this environment and amongst these particular rivals or predators?[14] It seems that these biologists are equating genes with existence; that is, as long as the genes are in the gene pool, the organism, in some mystical way, survives or is successful in its so-called struggle for existence.[15] One should, however, be able to perceive that genetic contribution is ordered towards the preservation of the species and offers nothing for the individual, while the struggle of this moth against that particular bird is ordered towards its own individual survival. It is clear that we are considering two orders which are perhaps dependent, but manifestly very different; nevertheless, to ignore this crucial distinction is to invite confusion. Life is clearly something more than mere genetic combinations; death is obviously something more than rejected genes in future gene pools. This moth might continue to contribute to the gene pool through its descendents, but unless it has some sort of effective defense or flight, it will simply become a tasty treat to a hungry bird and be no more. Perhaps we have overemphasized the role of survival in the biological world until it is no longer recognizable, but as least this moth has not, in its very real struggle for continued existence.

All creatures vary; but in order for the variation to be perpetuated, the variation must be always in terms of life or death. Many prominent evolutionary biologists, due to the influence of biologists R.A. Fisher, H.J. Muller, J.B.S. Haldane, and Sewall Wright, now maintain that though the selective differences might be very

14. Cf. Marjorie GRENE, *The Understanding of Nature: Essays in the Philosophy of Biology*, Boston, Reidel Publishing Company, 1974, p. 164.

15. Professor Grene points out that this position reduces to the absurd view that the entire biosphere is merely a vehicle to recombine and perpetuate the genetic forms. (Cf. *op. cit.*, p. 277.) Genes are not necessary forms, nor are they the epitome of the universe. Juxtaposed with our common experience of life, this notion is ridiculous.

small, even indiscernable, they are still very effective.[16] While this position is not shared by all of the evolutionary biologists, it is most unscientific, and it is also inconsistent with the theory of natural selection.

The most vocal dissenter to this position is Professor Simpson, who argues that we simply lack the ability to observe the efficacy of such a weak selective value in either Nature or the laboratory. Simpson had to concede, though with some hesitation, that the mathematical argument could not be substantiated and was, in fact, mere speculation.[17]

Moreover, even if the selective differences are detectable, it does not necessarily follow that they will contribute to the individual's survival or success in reproduction.[18] Natural selection, despite all the claims to the contrary, does not explain the reasons for all of the differences between biological entities.

Notwithstanding Professor Simpson's qualifications, the position itself seems to contradict other parts of the doctrine on natural selection. For, if the selective advantages are only detectable over long periods of time, it would seem to indicate that natural selection cannot act in the here and now — it is too weak, too insignificant, or the selective differences are not sufficiently pronounced; rather, natural selection can only be effective over an extremely long period of time.[19] Yet to hold this would be unacceptable to neo-Darwinism which maintains that there are no trends or gradual movements in natural selection. Moreover, if natural selection is too weak to work at this moment, or at any other given moment, when does it work? If, by the nature of the doctrine, natural selection has to select what is immediately advantageous, then it must be able to operate at any moment, which is impossible if the selective differences are only detectable — and for that matter effective — over a long period of time; the contradiction remains.

Another problem with the mathematical proof is that it does not conform with the modern understanding of being "fit" in natural selection. Neo-Darwinians maintain that natural selection is only the survival of the "fit" and not, as it was previously maintained, just of the "fittest". The new interpretation of natural selection employes a broader and more tolerant view of fitness which, incidentally, corresponds better with our experience of nature.[20] However, if the range of fitness in

16. Cf. Julian HUXLEY, *Evolution as a Process*, London: George Allen and Unwin Ltd., 1958, p. 3.

17. Cf. George G. SIMPSON, *op. cit.*, pp. 118–119; cf. also SIMPSON, *Tempo and Mode in Evolution*, New York, Columbia Uni. Press, 1944, p. 81.

18. Cf. SIMPSON, *op. cit.*, p. 78. Simpson goes on to argue that there is no proof that something is adaptive or not, but the somehow seems to forget that the burden of proof rests on the person who asserts the position that all differences have selective value, and not on the person who, like Simpson, does not.

19. Cf. M. GRENE, *op. cit.*, p. 169; cf. also T. DOBZHANSKY, *op. cit.*, p. 368.

20. Hence, if the length of the giraffe's neck could vary up to 12 inches from the mean and still be considered "fit", the difference of a mere half inch, although detectable, would not render its owner decisively superior or inferior to his neighbors. In order for one group of giraffes to become superior and, therefore, selected, they must have considerably longer necks than the rest of the community. The selective values of the modern interpretation must be larger, rather than smaller, than the ones permitted in old interpretation of the theory of natural selection with only the "fittest" surviving. If, however, the differences must be significantly decisive, there are additional problems: One advantage must be co-ordinated with a series of other changes. An additional change in neck length

terms of survivors and successful generators is much broader, the decisive differences must then be much more pronounced, lest every creature survive and generate — with perhaps the exception of the sickly and deformed creatures. If the differences must be more pronounced, the selective values must be very significant, which is contrary to what was established in the mathematical argument. Therefore, the mathematical proof, despite its awesome appearance, does not seem to be consistent with the actual doctrine of natural selection, nor does it seem to be an hypothesis capable of accounting for the biological phenomena.

Furthermore, if everything is explained (or justified) in terms of immediate contributions to survival or reproductive success, how would presently disadvantageous characters be preserved? For, as Professor Dobzhansky argues, a character must always be useful in order for natural selection to permit its development or even allow its continued existence.[21] Yet, despite our expectations, these disadvantageous genes and characters are, in fact, preserved.[22] Hence, either there is a contrary principle operating that preserves these genes during unfavorable periods, or natural selection does not operate at all times. In either case, natural selection, according to the present statement of the theory, is not an adequate biological explanation or mechanism.

Even to argue, as some evolutionary biologists have, that these temporarily-disadvantageous characters would be supported by natural selection because of the great advantage they will provide in the future, is not defensible. For, one would then be forced to show that natural selection would be ignoring — and not ignoring — the organ's temporary uselessness. In other words, we would end up by denying the principle of non-contradiction, for natural selection would have to support and destroy the immediately disadvantageous at the same time. The continued presence of the disadvantageous gene poses a serious difficulty to the theory of natural selection.

Most neo-Darwinian evolutionary biologists would readily concede that a biological system is not operative until complete, and furthermore, that this process might take even long geological periods of time. Yet what happens to the organism while it is waiting for the specific random mutation necessary for completion? For the inoperative part will be a hindrance to the organism, and it will therefore be

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must be simultaneously accompanied by a host of changes in muscle structure, vertebrae, circulatory and neural systems, etc. And if not perfectly timed, these changes will be detrimental to the system as a whole and thus be eliminated by natural selection.

21. Cf. T. DOBZHANSKY, *op. cit.*, p. 368. In all fairness, one should point out that not all of the evolutionary biologists insist on such strict standards. The most vocal dissenters are R.C. Lewontin and G.G. Simpson, who maintain that changes will be permitted by natural selection just as long as they do not prove to be significantly disadvantageous. These dissenters seem to be departing from certain tenets of the doctrine of natural selection. This might be accountable to sloppiness on their part or an inherit weakness in the position of natural selection, but most probably it reflects Lewontin's and Simpson's awareness that Dobzhansky's position, although a logical consequence of the doctrine of natural selection, does not explain sufficiently the biological phenomena. This insight is not infrequent; but it is downplayed by most neo-Darwinians.

22. Cf. F.J. AYALA, "The Mechanisms of Evolution", *Scientific American* 239, September 1978, p. 55. Since a force cannot act and not act in the same way and at the same time, there must either be another force or the selective forces are not strong enough to eliminate the disadvantageous character.

eliminated by natural selection, which would favor a simpler, but more immediately advantageous, organ. Moreover, what would retain all the other necessary, but temporarily useless and even harmful, variations intact until the entire system is operative?[23] These corresponding variations in the rest of the system are necessary for the new character to be advantageous to the entire system, but everything must be carefully co-ordinated lest the new character should continue to be useless. Evolution, despite romantic presentations, does not have all the time in the world. If it cannot help this organism on this tree escape from this predator, it has failed to perpetuate an organism, no matter how perfect or useful the organism might have been.

Furthermore, why would an organism strive to have a more complex system, especially if the more sophisticated system would be at a disadvantage until it is operationally complete? Optic nerves cannot serve any other capacity while they are waiting for the final development and completion of the eye. A "fat" cell cannot double as an "optic" cell until needed in its own proper capacity. These cells have very different structures which will not permit them to operate outside their proper function. These differences are made for the sake of something that does not yet exist, yet the body will constantly attend to their growth and development.

There are undoubtedly evolutionary biologists who would object to this approach as an oversimplification of the official explanation. Instead of cells assisting in some other capacity until ready to operate in their originally planned function, these biologists would maintain that there is a series of slightly advantageous mutations which slowly develop the function. Hence, due to some accidental chemical change in the skin or surface of the body, the body acquires a miniscule sensitivity to light, which gives it a small advantage over the others who are unable to detect changes in light at all. Over a long period of time, this optic sensitivity evolves into a rather sophisticated eye by small chance mutations, each offering more and more advantages to its owner.

This position is not without its own problems. First of all, the chemical change or skin mutation must be reflected in the genes or it cannot be transmitted to the offspring. Secondly, if such a mutation is to be perpetuated in succeeding generations, a single instance of it will not suffice; many instances of the desirably must occur, and these instances must, moreover, be simultaneous. The likelihood of a mutation being successfully transmitted depends on the frequency of its occurence of such an event. A rare event, therefore, even if transmitted successfully at first, will usually disappear altogether.[24] On the other hand, if a particular organism possesses an advantageous characteristic which is shared by other organisms, that advantage is not likely to be a selective advantage for its owner. Yet, if the organism does not share the advantageous characteristic with other organisms, how would the owner be able to preserve the advantage for as many generations as needed until the chance mutation is acquired by others. Thirdly, the possession of a primitive neural or

23. Cf. James COPPEDGE, *Evolution: Possible or Impossible*, Grand Rapids, Zondervan Publishers, 1973, p. 89.

24. Cf. J.B.S. HALDANE, *op. cit.*, p. 138.

optical system does not necessarily constitute a selective. For the organism must make a connection between the sense impression received through its recently acquired senses and the appropriate response to those impressions. If it can detect that the light has changed, but cannot distinguish between the sun going down and the shadow of an approaching enemy, the newly acquired sense is of no real advantage to its owner. The change of light must be already associated with danger ; and if this new information is ultimately to prove useful, the animal must be able to react adequately by flight or defense. Thus, for instance, if the organism is permanently fixed to a particular rock or surface, the mere knowledge of an approaching enemy might utterly fail to offer anything advantageous in terms of life or death. Undoubtedly, this reasoning is based on the unsupported assumption that a primitive optical system, which is capable of distinguishing changes of light, would be sufficient for detecting enemies. It is, again, the author of such doubtful assertions, rather than the one who questions them, upon whom the burden of proof rest.

It is only on the presupposition that complexity is an advantage to an organism that natural selection can succeed as the explanation it claims to be. But supposing this presupposition to be true, why have the complex organisms not eliminated the simple ones? How is it that reptiles thrive in co-existence with mammals? Natural selection fails to explain clearly what advantages the complex have over the simple and, moreover, why these advantages have not been hitherto utilized, as the doctrine predicts, by the more complex animals as of yet.

There have been attempts to skirt this objection by claiming that it is more advantageous for the organism to live in harmony with a diversity of living forms. However, this counter-argument is a subtle appeal to order and finality — something which is blatantly unacceptable to a doctrine based on a blind causal mechanism working with chance mutations.

Again, we must remember that utility is only to be understood in terms of personal survival or reproductive success. No matter how versatile our organism might be, if it is not constantly useful in these two aspects, it will not be preserved or be further developed. However, our common experience of Nature reveals many instances where things persist, and even flourish, although they are not constantly useful.[25] Nevertheless, a serious biological explanation must not only be able to explain why things have disappeared, but, more importantly, to be able to explain how things came to be and why they are in this particular way. Natural selection may account for what has failed to survive and what does not exist;[26] but for what actually exists in the biological world, and for its remarkably determinate form both within the individual forms of life and in the order among them, natural selection is an embarrassingly inadequate scientific explanation.

25. To argue that everything is constantly useful, whether we can observe it or not, is simply begging the question.

26. Cf. R.C. LEWONTIN, "The Basis of Conflict in Biological Explanation", *Journal of History of Biology*, Vol. II, 1969, p. 41. Lewtontin has even gone so far as to say that natural selection is not an explanation at all, but merely a statement of certain empirical facts, most of which record those things that did not survive.

Diversity, however, cannot be adequately explained by natural selection; for often several different variations are equally efficient in contributing towards the individual's survival or reproductive success. For example, evolutionary biologists have in the past supposed that the evolution of horses with one rather than two toes might be accounted for by a greater ease in running which results for the horse. The paleontologist O.H. Schendewolf, however, maintains that the actual number of toes on the foot of the horse cannot be attributed to natural selection, since running on two toes is just as efficacious as running on only one.[27] Or again, according to Richard Lewontin, the color brown seems just as effective for survival for the polar bear as the color white.[28] Alos, it is difficult to see why some plants need to be pollinted by insects when pollination by the wind is just as effective in normal circumstances. Stranger still, some wind-pollinated flowers possess much beauty and aroma even though they do not need to attract any insects whatsoever for their survival or reproduction.

Natural selection does not seem able to account for most of the beauty in Nature, since beauty rarely contributes directly to the individual's success in reproduction or survival. If the dove can succeed with a very primative nest of a few twigs, why must the oriole, which lives in the same environment, build a highly ornate and complex nest?[29] As James Coppedge points out, most adaptations or biological innovations cannot be explained by the working of natural selection, because they do not significantly, or even directly, contribute to the life of the generator or the success of his offspring.[30] Natural selection, therefore, fails to explain adaptation, complexity, diversity, and beauty in nature — the very phenomena purported to be accounted for by the action of natural selection.

According to Charles Darwin and the neo-Darwinians, if an organism fails to vary in the manner necessary for adopting to the changing environment, it will be eliminated, either by not being able to endure new changes or by being outnumbered by the more prolific neighbors. In other words, everything must adapt in order to survive, and what has survived must have adapted.

These assumptions seem to have some difficulties of their own, for they do not appear to be supported in reality and are, in fact, contradicted. There seem to be some creatures which have not changed for eons but which still flourish along with their neighbors. If their neighbors had to constantly change in order persevere, why did not they? Despite the graphic and numerous changes in the climate, the

27. O.H. SCHENDEWOLF, quoted by M. GRENE, *op. cit.*, p. 236.

28. Cf. R.C. LEWONTIN, "Adaptation", *Scientific American* 239, September 1978, p. 164. While there are some animals whose survival is substantially or even entirely dependent on their ability to blend into the surrounding environment, it is not essential to all, especially amongst the higher animals. A bear might not have to work as hard if he possessed an element of surprise with a white coat, but, as Lewontin goes on to argue, the color white is in no way necessary for the bear's success in reproduction or survival. But if there are adaptations which go above and beyond mere survival or reproductive success, then natural selection can not completely account for the existence of biological adaptations.

29. Cf. J. COPPEDGE, *op. cit.*, p. 88.

30. Cf. T. DOBZHNASKY, *op. cit.*, pp. 367-368; cf, also F.J. AYALA, *Evolution*, ed. T. DOBZHANSKY *et al.*, San Francisco, W.H. Freeman and Co., 1977, p. 498.

surrounding environment, and the introduction of new neighbors which might be rivals, predators, sources of food or carriers of disease, there have been many instances of animals and plants which have remained virtually unchanged down through the ages. Anyone who has been on a picnic recently has never worried about the possibility of the ant becoming extinct. The ant, the crocodile, the armadillo, the platypus, the oyster, the opposum, and a host of other so-called "living fossils," all seem to flourish.[31] There are, on the other hand, animals which appear to be equally (or even more) able to adapt than their neighbors, which nonetheless become extinct. The North American horse possesses adaptive characteristics similar to those of the North American bison; but one is extinct and the other thrives.[32] The disappearance of the Irish Elk and the Sabertooth tiger is equally mysterious; many evolutionary biologists concede their misgivings about the likelihood of ever coming up with a certain explanation of these cases.[33] Hence, whatever actually caused their success or failure in surviving, we must refrain from attributing adaptability, or lack thereof, for there is no evidence whatsoever that adaptability had anything to do with their continued presence or sudden disappearance. It is not correct to maintain that everything must adapt in order to survive, that adaptation is a guarantee of survival, or even that what has survived must have adapted.

What does it mean to say that an organism with favorable variations will be selected and will survive and that one with disadvantageous variations will perish? Are we speaking of the individual? Assuredly not, for the individual will soon perish anyway. Are we referring, then, to the genes possessed by the individual? Perhaps, but if only a single organism possesses certain superior genes, those genes will quickly disappear themselves. If the advantageous character is recessive, it will disappear just as quickly unless the recessive trait appears very frequently in the stock. If, however, the imperfect transmission of the genes — mutation — occurred with an individual, its offspring will differ from it insofar as they are the consequences of a superior gene combination while it is not. Again, what survives? The species? No; it must change with the fluctuating environment or face inevitable extinction. Hence, the transformed species may not be the same kind as its originators, so the species may finally not survive at all. If the individual, genes, or species does not survive, what does? Is survival nothing more than an opportunity to make a contribution of genes to the gene pool which are slightly altered and slightly superior to those of one's competitor? This can not be the answer simply, for evolutionary biologists maintain that Nature does not strive, consciously or otherwise, in the evolutionary process. If the "great scheme" lacks drive or goals, it would seem strange that the individual should have them. Since neither Nature nor its members tend anywhere, selection can only be a chronicle of survival of whatever happens to survive, whatever that means.

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31. Cf. Norman MACBETH, *Darwin Retried: An Appeal to Reason*, New York, Delta Bks., 1971, p. 121; cf. also G.L. STEBBINS, *Variations and Evolution in Plants*, New York, Columbia Uni. Press, 1950, p. 518; and G.G. SIMPSON, *The Meaning in Evolution*, New Haven, Yale Uni. Press, 1967, pp. 101, 192-195.

32. Cf. G.G. SIMPSON, *Major Features in Evolution*, pp. 294-295.

33. *Ibid.*, pp. 147-148, 286.

One of the most frequent objections against the theory of natural selection is that it is a sophisticated tautology. Most evolutionary biologists seem unconcerned about the charge and only make a token effort to explain the tautology away. The remainder, such as Professors Waddington and Simpson, will simply concede the fact. For them, natural selection is a tautology which states a heretofore unrecognized relation: The fittest — defined as those who will leave the most offspring — will leave the most offspring.[34]

What is most unsettling is that some evolutionary biologists have no qualms about proposing tautologies as explanations. One would immediately reject any lexicographer who tried to define a word by the same word, or a thinker who merely restated his proposition, or any other instance of gross redundancy;[35] yet no one seems scandalized that men of science should be satisfied with a major principle which is no more than a tautology. Until there is a successful resolution to this problem, as well as most of the others already mentioned, the theory of natural selection can never be seriously scientific.

Conclusion

One concludes this philosophical investigation with a perplexity similar to that which Darwin confided to his friend and colleague, Asa Gray,[36] that is: is natural selection a sufficient principle for Nature? Despite our apparent confidence in this controversial principle, buttressed by over a century of discussion and experimentation, we are not completely satisfied with the hypothesis, nor can we successfully answer all the difficulties. We are still haunted by the same question that plagued Darwin a century ago.

One can not help but be impressed with Nature's vast armory of defensive mechanisms and tools for survival of the individual and for the perpetuation of the species.[37] We are dazzled by Her skill and complexity, charmed by Her graces and beauty. Yet we are frustrated, more often than not, with our own inability to understand Her ways. We are mocked by the dogged persistance of fossil species and baffled by the mysterious disappearances of seemingly adapted species. We are embarrassed by all the contradictions, incongruities, and problems in our

34. Cf. WADDINGTON, "Evolutionary Adaption" in *Evoution After Darwin*, ed. S. TAX, Vol. I, Chicago, Uni. of Chicago Press, 1960, p. 385; cf. also, SIMPSON, *This View of Life*, p. 81.

35. H.W. FOWLER, *Dictionary of Modern English Usage*, (by permission of Oxford University Press), p. 615: "To repeat the words or the substance of a preceeding sentence or passage may be impressive and a stroke of rhetoric, or a wearisome and a sign of incompetence, mainly according as it is done deliberately or unconsciously."
It is not the intention of this paper to determine what is the purpose, or lack thereof, of the evolutionary biologists in using tautologies. However, it does seem appropriate to question whether this is proper for a scientific explanation which uses a principle that is at best a rhetorical ploy, or, at worst, a sham.

36. Cf. Charles DARWIN, Letter to Asa Gray, 26 November 1860, quoted by P. APPLEMAN, *op. cit.*

37. For an impressive consideration of tools in Nature, see André TÉTRY, *Les outils chez les êtres vivants*, Paris, Gallimard, 1948.

explanations. Like Darwin, we find ourselves more dependent on our imaginations to carry us across the great gaps in our knowledge. The reasons for our difficulties are numerous and are by no means insignificant.

Our first apprehensions of the biological world are confused and most difficult to order according to any one principle. The biosphere does not seem capable of being measured by a single principle. For, while the lower animals seem to be ordered exclusively to survival and reproduction, the higher animals have other features and characteristics which are not readily reducible to the principle of mere utility.

Claws, fur, needles, scales, barbs, teeth, shells, and thorns seem to be ordered solely to the defense of the creature. Moreover, many of the simpler plants and animals stop living once they have reproduced or only survive until their young can fend for themselves. We might be able to get away with reducing all these instruments and behavior to mere survival; however, there are characteristics and animals that will not admit of such reduction. There are quite a few animals that continue to exist long after their reproductive cycle is over. While some animals try to generate as many offspring as the environment will permit, if not more, there are others that only produce one or two offspring in their entire lifetime. Darwin was baffled by the Fulmar petrel only laying one egg, and "yet it is believed to be the most numerous bird in the world." [38] What would be the advantageous factor of contemplation? Or, what would be beautiful colors to a color-blind insect? Clearly, utility is not sufficient. Yet one must find a comprehensive explanation for the entire biosphere and complex enough to account for the vast diversity found in Nature, and not a mere chronicle of facts. If we have learned only one lesson from the history of science, it is that this will not be an easy task.

These are only a few of the difficulties that arise out of our inability to comprehend Nature, and likewise, to formulate an adequate hypothesis to account for the biological phenomena. Nevertheless, despite the inherent problems, there are certain things we can know of the natural world with varying degrees of certitude.

Our hypotheses, if they are to reflect what we know about reality, must be measured in some way by reality. The conclusions to which our hypothetical principles lead must find their verification in controlled experimental confrontation with reality. Only thus can the principles themselves be validated. To accept anything short of this is to relegate our inquiry to the realm of the non-scientific.

Since natural selection is presented as a mechanism capable of accounting for the apparent biological order and changes, it is incumbant on us to determine whether it is a sufficient biological principle or not. If there are any deficiencies in the explanation, we must locate the source of the problem in order that we may successfully resolve the difficulties. One cannot successfully build without first establishing a good foundation, nor reach a distant goal with only defective bearings.

In order to determine whether natural selection is a satisfactory biological mechanism, we have carefully examined the arguments, terms, and ramifications of the hypothesis. We have found that some of the premisses have unsupported

38. C. DARWIN, *op. cit.*, p. 54.

biological assumptions that were merely borrowed from other disciplines. These assumptions must be grounded in our observations and experiments and not in assertions and conjectures. The tautologies that were discovered must be eliminated, along with the *petitiones principii*, and the inconsistencies within the actual hypothesis must be corrected and be made to fit the phenomena more perfectly. We should not feel obliged to assume the presence of advantageous characteristics without any evidence whatsoever, for the burden of proof always rests on the person making the assertions.

Moreover, the hypothesis must be enlarged in order to account for the fact that some disadvantageous characteristics persist and even flourish. We must accept the fact that the organisms or organs need not be useful at every moment in order to be preserved or developed. Natural selection must not only be able to explain why certain organisms accept temporary disadvantages in order to become more complex; it also must explain why the simple can still co-exist with the organism of supposedly more advantageous complexity. Unless we can show by the principles under judgement how survival can account for altruistic behavior, beauty, and the useless in Nature, we shall have to seek another principle that can do so. If the doctrine of natural selection cannot be enlarged, an alternative must be sought; for no denying or ignoring the facts can fully satisfy our desire for a total and sufficient explanation.

Furthermore, we must account for the biological order without lapsing into anthropomorphism. We must explain the phenomena without hiding behind esoteric or scientific jargon in order to conceal our ignorance. Nor should we settle for vague predictions, reminiscent of the Oracle of Delphi, or accept such an indeterminate formulation that we can never apply the hypothesis to the actual phenomena.

The difficulties raised should not be ignored or downplayed. We must deal with them before we can hope to proceed further. Yet, despite the present flaws of this hypothesis, we ought also to appreciate the great insights which the doctrine of natural selection and its major protagonists have provided for us; for it is always a source of delight to discover whatever intelligibility we can in the mysteries of Nature.