Is Man Here To Stay?

Throughout evolutionary history all dominant forms of life except man have been supplanted. Thus far the new dominant forms have sprung from unobtrusive, unspecialized creatures

by Loren C. Eiseley

THE THOUGHT that the human race may one day disappear from the earth is somehow intolerable, even though in most epochs men have not considered the danger immediate or personal. Man has never been finicky about speculating on the possible end of the planet; the event lies so far off in the indeterminable future that it is scarcely real to finite brains. But the end of a dominant species, particularly if it be one's own, is not so easy to dismiss with a shrug. Even scientists seem loath to deal with the subject. The idea clashes with our submerged yearnings for a goal, for a purpose related to ourselves. The notion of human extinction troubles our wish to participate, even though vicariously, in the triumphs of our descendants, and to see their line perpetuated through the unbounded eras of the future.

I have before me a scientific work in which the author writes optimistically: "The earth may last for ten thousand million years yet before it and all its life are dead, so man has more time at his disposal than ever the dinosaurs had." Pierre Lecomte du Noüy in *Human Destiny* goes even further. He says that from now on man's "path separates from that of the rest of living beings, which he will always dominate. Evolution will continue through him alone." The appeal of such reassuring expressions is obvious. They link with Tennyson's hopeful dream of "that far-off divine event toward which the whole creation moves."

Yet the archaeologist who has wandered among the fallen columns of dead civilizations, and the paleontologist who has delved into wastes of time in which whole orders of life have vanished, may well bring a certain austere perspective to the consideration of this happy fantasy. In this dread hour of prospective atomic warfare, it will do us no harm to measure man and the substance of his dreams with realism. If he is to find his freedom and his length of years, it can be only through an adequate knowledge of life and not of dreams.

There is a widespread tendency to conceive of the course of evolution as an undeviating upward march from the level of very simple organisms to much more complex ones. We are inclined to think of man as the crown and culmination of this movement and the natural point of origin for any further progress. The syllogism runs something like this: Evolution is an upward movement. Man is the most intelligent form of life on the planet. Therefore he will continue to dominate the earth throughout future time, or he will himself give rise to some more perfect and intellectual species as far superior to us as we are superior to our heavy-browed, lumbering forerunners of the Pleistocene.

This last statement is very significant. In it lies the major source of the confusion we manifest about human destiny. We know that man has moved along a particular line that has led to greater and greater intellectual triumphs. We know his brain has grown and his body has altered. We call this process evolution, and we tend not to understand why it cannot go on through an indefinite future. The confusion lies in the fact that we fail to distinguish adequately between progressive evolution in a single family line and those greater movements which adjust life to the rise and fall of continents or the chill winds of geological climate.

There is a pulse in the earth to which life in the long sense adjusts, but it is a rhythm so slow that it is imperceptible in short-line evolution. We can grasp its significance and its indifference to the aspirations of individual life forms only when we call the roll of the ages and note the number of the vanished. Even if we concentrate only upon the Age of Mammals, ignoring the strange departed amphibians of the Paleozoic or the stalking giants of the Age of Reptiles—even then we discover that whole orders and families have passed out of existence. Many of these creatures were highly successful in their day. Yet as one compares the durability of the simpler creatures with that of the more efficient, one may be led to comment cynically that to evolve is to perish. In general it is slow-moving, inconspicuous creatures such as the common opossum that have come down the long range of time unmodified and "immortal." It has been observed by students of fossil life that in a surprising number of instances the danger of extinction can be shown to be proportional to the rapidity of evolutionary change.

The subject is a very complex one, of course, because obviously the completely inadaptive organism cannot master a shifting environment. Life must evolve to live. Why, then, are we confronted with the paradox that he who evolves perishes? Are we not the highest animal? And what, among all things that fly or creep or crawl, is more apt to inherit the future than we are?

THE one great biological principle that seems to deny man's hopes for continued dominance of the planet is known as the "law of the unspecialized." It is one of the curious ironies of scientific history that the discoverer, or at least the formalizer, of this law was a devout Quaker scientist who put forth his views during the full flush of 19th-century enthusiasm for evolutionary progress. He was Edward Drinker Cope, undoubtedly one of the greatest naturalists America has ever produced. It is hardly necessary here to enter into a sterile debate as to what constitutes a biological "law" or whether such laws exist. Let us call Cope's "law of the unspecialized" merely a brilliant generalization, based on his extensive knowledge of the vertebrate faunal successions throughout past time.

The gist of this generalization is that the leaps ahead in evolution generally take off from comparatively unspecialized forms of life, rather than from the most highly developed. In Cope's words: "The highly developed, or specialized types of one geological period have not been the parents of the types of succeeding periods but . . . the descent has been derived from the less specialized of preceding ages." It is the more adaptable and generally the smaller forms that are best able to meet the onset of new conditions which destroy the already dominant and successful types. The first am-

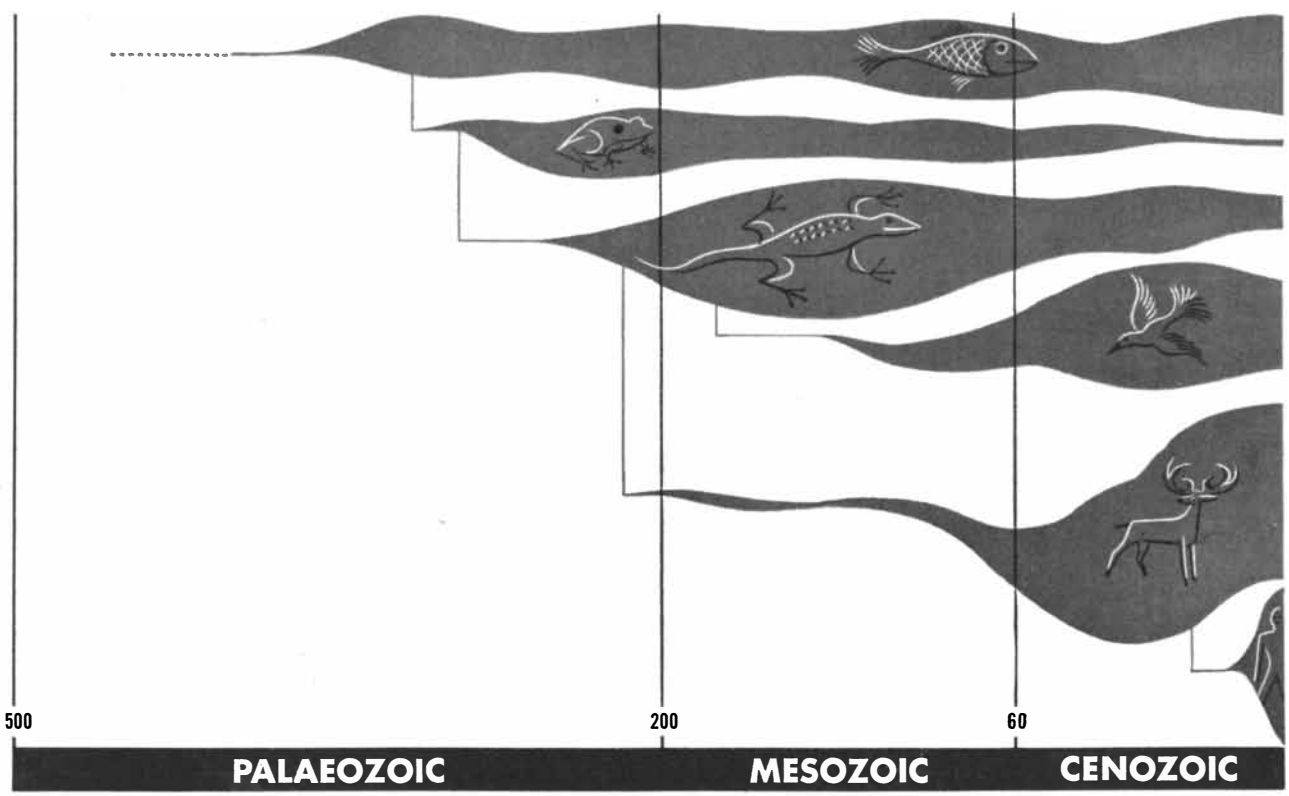
phibians arose not from a highly successful fish but from a slow-swimming, foul-water form which had to be peculiarly adaptable. Similarly, the first mammals came not from one of the specialized dragon reptiles but from a smaller and much less specialized reptile which was learning to control its blood temperature. Another climbing, jumping reptile became a bird. All were small, all were the fortunate possessors of traits that offered the potentialities of successful adaptation to new climates or new media.

Each of these insignificant, stumbling but remarkably endowed creatures founded explosive dynasties. Climbing out of the seas and marshes to the uninhabited air or land, entering into some still region whose previous occupants were dead, they radiated with amazing rapidity into a diversity of forms. The new forms grew ever more specialized as they adapted to the particular niches in the environment that they came to occupy. Many of these specializations are of quite remarkable character. Yet in the long course of evolution they threaten to reduce the adaptability of the form in case it should ever find its particular evolutionary corridor blocked or destroyed. The problem is a little like that presented to an elderly glass-blower, let us say, when glass-blowing becomes mechanized. His environmental zone has changed, yet he is old; he is no longer able to master a new field. He is through —and so it may be, in even more brutal ways, in the world of animal life.

IT is true that the history of evolution shows some instances in which a specialized form continues successfully for a long period, vanishes and then millions of years later is reincarnated in the form of similar adaptations in the same environment. Such oddities are not always easy to explain. Probably in some cases the death of a dominant form destroys its enemies along with it, so that the particular corridor is left open for renewed exploitation by a later creature which begins to evolve down the same pathway. A typical instance has been described by Edwin H. Colbert of the American Museum of Natural History. The crocodile-like Phytosaurs of Triassic times became extinct, yet the same environmental zone was entered by the true crocodilians in the Jurassic, and they have continued to be a highly successful organism ever since. Though unrelated, both reptiles assumed remarkably similar shapes. This is progressive evolution in a limited sense, but it is a very confining type of movement.

The kind of evolution that produces great advances or changes must be more versatile. Thus the small arboreal animals of the Age of Reptiles, having achieved a stable body temperature, survived the passing of the dinosaurs. Venturing on to the world of dry land, they underwent an explosive radiation which carried some of them back to the sea, some of them into the night world of the mole, some into the armor of the slow-moving Glyptodons. Some reached elephantine proportions, some inserted themselves into tiny environmental crevices where they survived as rare oddities. Each, in a sense, sacrificed something for a narrower proficiency; the armored his speed and wit, the great carnivore his ability to live if his prey became extinct.

Thus the evolutionary paradox becomes plain: The highly and narrowly adapted flourish, but they move in a path which becomes ever more difficult to retrace or break away from as their adaptation becomes perfected. Their proficiency may increase, their numbers may grow. But their perfect adaptation, so necessary for survival, can become a euphemism for death. Climates change, vegetation changes, enemies perfect their weapons, continental ice-fields advance, indirect competitors may smother the corridor. Sooner or later an impasse develops, an impasse which a small, omnivorous creature that has "specialized" in generalized adaptability and inconspicuousness may escape, but which the perfected evolutionary instrument



EVOLUTION OF VERTEBRATES is roughly plotted on the basis of time and the relative dominance of each group. From top to bottom are fishes, amphibians, reptiles, birds, mammals and man. The horizontal coordinate is numbered in millions of years. New groups sprang from early unspecialized forms of older groups.

never can. Consider, for example, the disaster that would overtake an animal like the tubular-mouthed toothless anteater if extinction overtook the social insects. The anteater could never readjust. He would starve in the midst of food everywhere available to the less specialized. He will last only as long as his strange environmental niche remains undisturbed.

The question we are mainly interested in is: Is man a specialized or a generalized creature? Are we the refined endproduct of an evolutionary line whose genetic plasticity has about reached its limit, or are we the departure point for an undreamed of future? An answer of sorts can be given, but it has to be given with great care and with much attention to precise definition. We will want to ask, first of all, whether there really is such a thing as an "unspecialized" animal. My answer is that there is, and that, furthermore, it robbed our kitty's food dish last night. It is no mere intellectual abstraction.

PROBABLY the major confusion that has developed about Cope's principle of the unspecialized animal is the tendency to imagine it as some kind of inchoate "archetype" creature capable of galloping off in several evolutionary directions at once. No such animal ever existed, and Cope never intended to suggest that it had. The term "unspecialized" is used only in a comparative sense, and in this sense we need not look far, even today, to find examples. The opossum that stole up our back stairway last night and turned the cat's tail into a frightened bush has marched unchanged through 80 million years of geological upheaval. As George Gaylord Simpson observes in his widely read recent book, *The Meaning of Evolution*: "It has been suggested that all animals are now specialized and that the generalized forms on which major evolutionary developments depend are absent. In fact all animals have been more or less specialized, and a really generalized living form is merely a myth or an abstraction. It happens that there are still in existence some of the less specialized—that is, less narrowly adapted and more adaptable—forms from which radiations have occurred and could, as far as we can see, occur again. Opossums are not notably more specialized now than in the Cretaceous and could almost certainly radiate again markedly if available space were to occur again." Nature, in other words, seems to keep available creatures whose life zones are broad enough for renewed experimentation if the need arises.

It is evident, then, that there are two currents in the evolutionary flow, although neither is completely separate from the other. There are times when only a person gifted with foreknowledge of the future could indicate which of these streams means progress. But in general one of the streams is not really progressive. It is simply the perfection of specialization: the creation of the ideally adjusted parasite, of the glowing monster of the abyssal seas, the saber-toothed tiger, the fish with batteries in its belly. All of this is remarkable beyond words, but beneath these superficial diversions a deeper flow has carried life up from the waters, perfected its chemical adjustments, conquered the land, stabilized bodily temperature, developed nervous systems of growing complexity and brought into being the mind, whereby the universe examines itself.

So far this broad upward movement has never retraced its steps. Not that it has not wandered or specialized, or lost itself in peculiar and constricted niches, but once a new level of organization has been attained, it has not been lost, and the old has dwindled in importance. The Crossoptyrigian fishes gave rise to the amphibians and vanished almost totally. The amphibians, making further lung and limb adjustments, then gave rise to the reptiles. The latter then contributed the two great living groups—the mammals and birds. In all these cases it was not the largest or most highly specialized of the new classes that produced the succeeding forms. It was instead the smaller, less spectacular and more adaptable types. Man, who derives from a comparatively generalized and ancient order of mammals, has opened a strange new corridor of existence—the cultural corridor. With the appearance of culture the biologist is confronted with a true innovation.

THERE exist in various obscure parts of the globe certain ancient and remarkable forms of life. They are, one might say, the immovable immortals. Is that quick-witted, volatile and short-lived parvenu, man, destined to join their company? Has his mastery over environment, the greatest yet achieved by any animal, created the first highly specialized but truly adaptable organism? Does his one great specialization—his brain—mean escape at last from the disasters that have stalked all other forms?

There is a creature something like man that may provide a hint, though it crawls in another shape. Like man, it is an agriculturist and a city builder. It numbers, like man, in the millions, and like man it has mastered the problem of food storage and distribution. In its dark cities it knows something of the common warmth and security, the thrusting back of the harsh natural environment, that man has so recently achieved. This creature is the ant.

You will object at once that ants are physically and mentally remote from men. So they are, but in their tremen-

dous, if minute, activities they have achieved a remarkably humanlike adaptability. The tropical Attas ant, for example, has solved the food problem by controlled culture of domesticated fungi. We need not linger over the details or over the even more ancient kingdoms of the termites. The important point is that the ants have led their present lives for more than 80 million years, while man's civilization is scarcely more than 7,000 years old. They are the oldest cosmopolites; they have sheltered longest, grown food, escaped many of the violences of the mammalian world. We shall want to ask just one question: "Have they changed?" It would seem they have changed very little, if at all. They are one of the small "immortals." They attained their present relatively high biological specialization very long ago and have since been marking time or evolving so slowly that the modifications are extremely minor.

The reason for this long life without noticeable change would seem to lie in a perfect environmental balance. Even the creatures' parasites are old. The remarkable instinct-built cities, playing a part roughly equivalent to our own metropolises, have provided shelter, food and protection. The stability of perfect adjustment has set in.

It can justifiably be contended, of course, that man, by reason of his cultural malleability, his ability to invent, to progress, to introduce changes into his environment, is in a much more dynamic and unstable relationship with nature than the social insects. But it is also true that man's cultural proclivities are directed toward making life easier for himself. He prepares food which makes an elaborate dentition superfluous, and which actually encourages its disappearance. His machines transport him with little effort on his own part. His clothing, his air-conditioned houses, his medical devices all protect him from the harsh natural environment that controls the survival and directs the evolution of other animals. As a living organism man is still susceptible in some degree to environmental influences and genetic drift, but natural selection has ceased to operate intensively upon him. To be sure, competition in implements and methods of warfare may well determine the increase or relative decline in significance of particular racial types in given moments of human history. There is nothing in the present life of man, however, to suggest the likelihood of striking increases in brain development or other remarkable innovations in human structure. We may expect at most a few mild changes toward a reduced dentition and other small adjustments if civilization and its luxuries continue.

Man, in other words, gives every sign of having reached, by a different road from that of the social insects, an equivalent environmental mastery. It would take a formidable and unforeseen world cataclysm to thrust him once more naked into the wilderness out of which he emerged. It is conceivable that his propensities for destruction may bring about his self-extinction, but because of his worldwide distribution and enormous expansion in numbers this is extremely unlikely.

The 19th century drew from the century before it a concept of human progress which the evidence of the earth's history does not entirely justify. Evolutionists do not see at work any inner perfecting principle that would automatically improve a given organism after it has achieved a certain stability of relationship with its environment. Rather the pace of evolution steadily becomes slower, until the vicissitudes of time demand new adjustments or force the now-specialized organism toward extinction. "No fixed law," wrote Charles Darwin, "seems to determine the length of time during which any single species or any single genus endures."

Darwin, like his 18th-century forerunners, believed in progressive change and predicted that "we may look with some confidence to a future of great length . . . all corporeal and mental endowments will tend to progress towards perfection." Yet curiously this quotation lies at the close of a paragraph in which he said: "Of the species now living very few will transmit progeny of any kind to a far distant futurity."

THE primate order is old. Man is a comparatively young branch of that order, but his great brain marks him as specialized in a way peculiarly apt to bring an end very soon to his physical modifications and advancement. Indeed, there is evidence that *Homo sapiens* has not altered markedly for hundreds of thousands of years. Yet man's strange specialization has introduced a new kind of life into the universe—one capable within limits of ordering its own environment and transmitting that order through social rather than biological heredity.

If man can master quickly his individualistic propensities for destruction, he may be able to become another of the small immortals. Even to this, however, judging by the records of the geological past, there will come an end some day. Sooner or later Cope's law of the unspecialized will have its chance once more. When it does, we can only hope that the beings who will replace our dominance upon earth may be, if not wiser and gentler, at least less diabolically inventive than ourselves.

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