Evolution

The Power of This View of Life

"We should never have sought either solace or moral instruction in Nature"

by Stephen Jay Gould

In the last sentence of *The Origin of Species,* Charles Darwin attributed multiple powers to life itself, but chose to designate the evolutionary perspective ("this view of life") as imbued with grandeur:

> There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved.

Darwin thus located evolutionary grandeur in a contrast between the repetitive motion of our planet's circuit about the sun and the fascinating narrative of life's history—a tale with a mysterious beginning, an enthralling unfolding, and an unpredictable end. The grandeur, in short, lies in the contrast between a well-oiled machine and an edifying story.

"This view of life" also emits power, for evolution represents the fundamental fact and central organizing concept of biological science, and Bacon proclaimed long ago that knowledge is power. Darwin clearly saw that his revolution included two distinct and separable components—establishing the fact of evolution (genealogical connections among all organisms, with life's history as a tale of physical "descent with modification," to cite Darwin's words) and proposing a theory (natural selection) for the cause of change. Darwin wrote in the *The Descent of Man*:

> I had two distinct objects in view; firstly to show that species had not been separately created, and secondly, that natural selection had been the chief agent of change...hence if I have erred in giving to natural selection [too] great power...I have at least, as I hope, done good service in aiding to overthrow the dogma of separate creations.

(Darwin's distinction was not only logically correct but also politically sound. The intellectual world had been ready for evolution's factuality, and had eagerly embraced Darwin's evidence, but his radical theory of natural selection found few takers during his lifetime and did not become a majority view until the 1930s. Darwin is buried in Westminster Abbey, literally at the feet of Isaac Newton, but he lies in hallowed ground for establishing the fact of evolution, not for proposing a theory about causes.)

Evolution surely stands first among the "outrages upon our naïve self love" that Freud identified as the cachet of all truly great scientific revolutions. I don't mean to downplay the mental adjustment required by the two other revolutions that Freud specified as paramount: changing our abode from the immobile center of a limited universe to a small peripheral hunk of rock subordinate to one star among billions, and altering our view of mind from a logical and moral instrument to a largely nonrational device buffeted or controlled by an "unconscious." Still, no demotion of hope can quite match the cancellation of our "particular privilege of having been specially created" (in God's image, no less) and our consequent "relegation to descent from the animal world."

Evolution therefore entered Western consciousness as the most threatening of all new ideas to our most fundamental social assumption and psychological hope for human uniqueness and centrality. Evolution in any guise had to pose a challenge and initiate a crisis. But many versions could have buffered the shock and sanitized the transition. The two components that Darwin identified—fact and theory—might have been formulated in a "friendly" fashion that challenged a minimal number of cherished assumptions. An instigator other than Darwin might, for example, have portrayed the pathway (the "fact") of evolution as inherently progressive and predictably leading to *Homo sapiens* as a pinnacle—the necessary result of a mechanism (the "theory") that conceptualized advancing neurological complexity as an ineluctable, internally driven property of living matter. In fact, most non-Darwinian theories of the nineteenth century did portray evolution in this more conventional and less threatening mode. (Our name for the process is a vestige of this search for comfort. *Evolution* comes to us, largely via Herbert Spencer, from an English vernacular usage meaning "progress." Darwin did not like the word and preferred "descent with modification." But most evolutionists did equate biological change with necessary progress, and Spencer's favored term stuck.)

Charles Darwin was a complex and contradictory man—an intellectual radical, a political liberal, and a social conservative. His personal wealth and his loving, protective home life allowed him to range freely (and dangerously) in the realm of ideas. Evolution, as argued above, would have been challenging enough to constitute Freud's greatest revolution in any guise. But Darwin's version cut right through the keystone of social convention and provided an ideologically radical account in the domains of both theory and fact. Auspicious beginnings often cascade to full achievements (and rolling stones gather no moss). Darwin started us well, but the transformation continues, and the surprises do not diminish. Perhaps we can only agree with the English biologist and writer J. B. S. Haldane that the universe is not only peculiar but "queerer than we can suppose."

The Radical Theory: Natural selection, as a theory about differential reproductive success and its consequences, could scarcely be less available for any hope that evolution might be either cosmically rational or just parochially directed toward the appearance of *Homo sapiens*. Natural selection is, first of all, a theory about adaptation to changing local environments, not a statement about "improvement" or "progress" in any global sense. Since environments alter in a meandering and unpredictable way through time, natural selection should not lead to any pathway of stately unfolding. (Darwin, as an eminent Victorian in a culture maximally committed to progress, did manage to smuggle predictable advance back into evolution via an ecological argument about competition in biologically crowded environments, but he remained committed to his radical proposal that the "bare bones" mechanics of natural selection permits no statement about favored directions for long-term change.)

Moreover, natural selection, expressed in inappropriate human terms, is a remarkably inefficient, even cruel process. Selection carves adaptation by eliminating masses of the less fit—imposing hecatombs of death as preconditions for limited increments of change. Natural se-

lection is a theory of "trial and error externalism"—organisms propose via their storehouse of variation, and environments dispose of nearly all—not an efficient and human "goal-directed internalism" (which would be fast and lovely, but nature does not know the way). Darwin certainly grasped this central irony of our being when he wrote to his best friend Joseph Hooker in 1856: "What a book a devil's chaplain might write on the clumsy, wasteful, blundering, low, and horribly cruel works of nature."

The Peculiar Pathway: We look at the paleontological pattern of life's unfolding, and we try to extract a story that suits our prejudices. We speak of an "age of invertebrates" followed by an "age of fishes, reptiles, and mammals," all capped by an "age of man." We draw our sequences of pictures and arrange our chapters in textbooks, so that trilobites come first and people last. But invertebrates have always dominated the world of multicellular animal life in numbers of species and prospects for long-term success, while *Homo sapiens* is one tiny twig on life's exuberantly branching bush. (I do not deny the unparalleled impact of our species upon the planet, but magnitude of result bears no relationship whatever to predictability of origin.)

This is not the "age of man"; it is not even the "age of insects"—a proper designation if we wish to honor multicellular animal life. As it was in the beginning, is now, and ever shall be until the sun explodes, this is the "age of bacteria." Bacteria began the story 3.5 billion years ago, as life arose near the lower limits of its preservable complexity. The bacterial mode has never altered; the most common and successful forms of life have been constant. Bacteria span a broader range of biochemistries and live in a wider range of environments; they cannot be nuked into oblivion; they overwhelm all else in frequency and variety; the number of *E. coli* cells in the gut of any human exceeds the count of all humans that have lived since our African dawn.

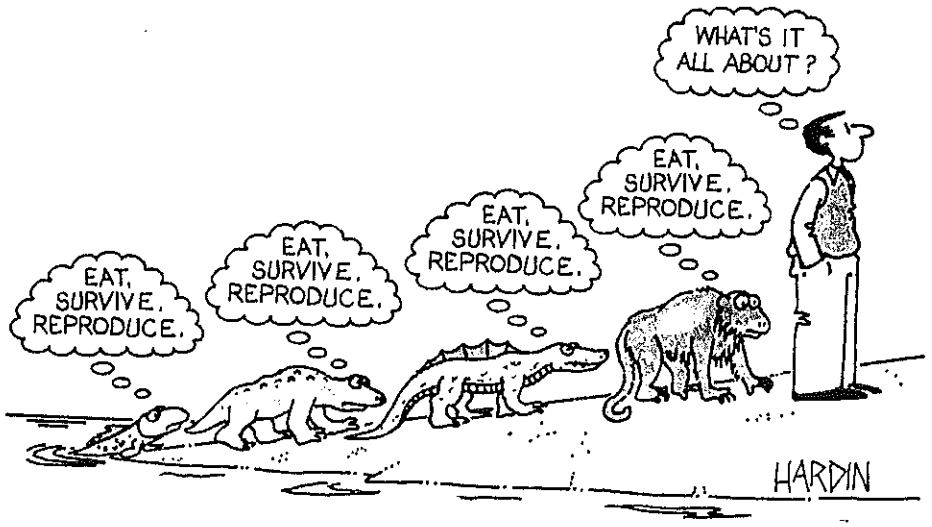
No trend of complexity or progress exists in the usual sense; the history of life features no upward thrust as a central tendency of evolution; the bacterial mode has persisted for more than three billion years. At most, every once in a while, a lineage or two tumbles into a domain of enhanced complexity, for this is the only open direction available (the numerous forms that evolve greater simplicity fall into a domain of overlap with creatures already existing). We focus upon this tiny tail in the distribution of complexity only because we reside there ourselves.

Moreover, the pattern of occupation for this small tail of complexity departs maximally from any notion of a predictably steady unfolding. With the exception of simple algae (a pathway unrelated to the genealogical story of animals), life remained unicellular for five-sixths of history. All but one phylum arose in a single geological whoosh, within some five million years or so, at the dawn of Cambrian times, 530 million years ago (the "lowly" Bryozoa, not our exalted chordate selves, form the single exception of slightly later origin).

In a basic anatomical sense, the history of life since then has been a tale of many variations on a few underlying themes. (I do not deny the unusual interest of some of these variations, including human consciousness.) The earth doesn't even permit exclusive evolution by the already messy and contingent rules of competitive natural selection. Mass extinctions punctuate the history of life, imposing regimes of death for reasons unrelated to Darwinian struggles of normal times. If a large extraterrestrial body had not struck the earth 65.3 million years ago, dinosaurs would probably still be dominating mammals, and no conscious being would have the privilege of pondering a world queerer than we can suppose.

How can Darwinism be exalting, and "this view of life" grand, if all our comforts be thus stripped away in favor of such messiness, contingency, and caprice in the details that matter (like the probability of our own evolution), with generalities confined to broad domains that offer so little solace (mass extinction as a recurring phenomenon; natural selection as a governing principle; invariance of the bacterial mode as a result). First, do not doubt the salutary effects of such a cold bath. We never should have sought either solace or moral instruction in Nature, who was not made for us, or even with us in mind, and who existed by her own rules for billions of years before we arrived. Better to learn a stern truth about marvelous multifariousness (and cosmic indifference to us) than to persist in a myth of warm cuddliness or intrinsic harmony that might channel proper attention from our own bodies and minds (true humanism) as the source of ethics and value.

Second, a world queerer than we can suppose must be, to anyone with a modicum of curiosity, so much more interesting a place than a planet crafted to feed our bovine complacency. Darwin's revolution remains incomplete, in Freud's crucial sense, until we face the cosmic insignificance that our own evolution truly implies—thus liberating us to grasp the deeply human meaning of our lives and most curious brainpower. We shall soon celebrate the two-thousandth birthday of a most interesting man who not only told us that the truth would make us free but who also spoke for all kinds of enlightenment in saying: "I am not come to destroy, but to fulfill."



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