

Stephen Jay Gould

**AN URCHIN IN  
THE STORM**

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*Essays about Books and Ideas*

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# **An Urchin in the Storm**

**BY STEPHEN JAY GOULD IN  
NORTON**

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# **An Urchin in the Storm**

*Essays about Books and Ideas*

**Stephen Jay Gould**

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From the heartland of vestigial American anglophilia  
To my two favorite British intellectuals—Arab and Jew by origin.  
*E pluribus unum.*

For Peter Medawar, a man of consummate bravery, penetrating intellect,  
unsurpassed *joie de vivre*, and unfailing encouragement to men of good will;  
and

For Isaiah Berlin, the polymath of our time, who once befriended a young scholar  
with no status at all, and who gave old Archilochus his biggest boost since  
Erasmus.

In appreciation for their inspiration but, above all, for their kindness.

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## Preface

**T**he U.S. Army Teaching Manual is a compendium of wise and practical advice from an institution that surpasses all others (probably even the public schools, since most kids retain some spark of interest) in its need to foist information upon an unwilling and unresponsive audience. This manual lists, as its first rule, “never apologize.” Yet I do not know how else to introduce a volume of book reviews (though my apology is only a tactical feint before the right cross of justification).

I once heard a speech by Herblock, addressed to aspiring journalists and dedicated to eradicating the notion that newspaper articles could be more than strictly ephemeral and eminently forgettable. He cited an old motto from the era before extra-duty plastic bags: yesterday’s paper wraps today’s garbage.

On the continuum from Rupert Murdoch to King James, old book reviews must, as a genre, fall at or very near the ephemeral end. A second argument against the preservation of book reviews lies in their central character—for no literary activity is so despised and excoriated (often properly so) as the reviewer’s art. I picture several reviewers of my own books as passing a long future lodged between Brutus and Judas in the jaws of Satan. The famous quip of Max Reger to a music critic well illustrates the dubious propriety of reviewing as a general activity, the attitude of creative people to the genre, and the ephemerality (and place of final disposal) for its results: “I am sitting in the smallest room in the house. I have your review in front of me. Soon it will be behind me.” Yet the very vehemence of dismissal also indicates—on the old Shakespearian principle of protesting too much—that reviews are not so lightly ignored. Charles Lamb proclaimed, “for critics I care the five hundred thousandth part of the title of a half-farthing.” But why waste such emotional verbiage on an activity really accorded (if I calculate correctly) but one forty millionth of an old English penny in value.

Yet books are the wellspring and focus of our lives as scholars. Commentary upon such a source should, at its best, be expansive and enlightening—a sign of respect for a basic product. That so many book reviews are petty, pedantic, parochial, pedestrian (add your own p’s and q’s, querulous, quotidian, quixotic)—so much so that they have folded what might be an honorable genre into their gripping nastiness—strikes me as a sadness that might not lie beyond hope of reversal. Why should articles of commentary on other books not lie within the domain of the essay?

To gain such a status as potentially worth preserving, such commentaries would have to forego what many take to be the primary charge of a book review—to present a detailed account of the work’s content and merit. (Most books, after all, are

ephemeral; their specifics, several years later, inspire about as much interest as daily battle reports from the Hundred Year's War). Another type of book review—one that uses another writer's work as an anchor for discussing an issue of wider scope—might provoke an author's ire, but might also gain, by its generality, entry into the class of essays.

Since I am most moved by general themes, but find them vacuous unless rooted in some interesting particular, I have always tried to write book reviews in this broader style. I even dare to hope that some authors might be pleased to see their particular work used as a focus for general discussion, rather than “reviewed” by the traditional listing of likes and dislikes. (I am at least consistent in foisting upon others what I hope for myself. Among all reviews of my own books, I particularly cherish a long article, also from the *New York Review of Books*, on “Ontogeny and Phylogeny” written by the great British zoologist, J.Z. Young. He wrote a wonderfully perceptive essay on the relationship between embryology and evolution, but only bothered to mention that I had written a book about the subject in the last two paragraphs. Made me think (I am not being facetious) that I had done something worthwhile in choosing a meaty subject, long neglected. I would much rather be an interesting particular for an enduring generality than an item of, by and for itself and the moment alone. *Verweile doch, du bist so schön.*)

These essays are not quite so unmindful of their generating products as Young on ontogeny. We must believe that books, and their ideas, have an enduring meaning worth consideration after an actual title goes out of print (though nearly all discussed herein remain on the shelves of good bookstores, at least as paperbacks). Each of these chapters uses an individual book to pursue a general theme, but organizes its discussion as a critique of content. (I have also written some reviews in the more conventional mode of local judgment—but these I have not included.) All but one of these essays originally appeared in *The New York Review of Books*. My deepest thanks to Robert Silvers, a great editor who makes fine (and even insistent) suggestions but who will not change a comma without consulting. I hope that these pieces follow his goal for a genre of general commentary rooted in the review of books.

My second rationale for this collection lies in the coherence that I (at least) detect among its disparate subjects. I didn't impose any theme as I worked piecemeal over a decade, but a judicious choice of titles by Bob Silvers combined with a personal, stubborn consistency of viewpoint—the hobgoblin of small minds to be sure—combined to record a particular view of nature and human life: the perspective of an evolutionist committed to understanding the curious pathways of history as irreducible, but rationally accessible.

I don't think that coherence is an unmixed blessing, or necessarily a virtue at all in our complex world. It forces one to take the hedgehog's part in that overused (and basically uninterpretable) aphorism, attributed to Archilochus and kept alive through the ages by scholars from Erasmus to Isaiah Berlin: “The fox knows many things, but the hedgehog knows one big thing.” Vulpine flexibility may be the greater virtue in such a diverse and dangerous world. Think what the real hedgehogs of history, Cortez and Pizarro for example, might have done with modern technologies of destruction.

Still, coherence—the way of the hedgehog—may be salutary for the harmless endeavor of forging a book from elements written separately and without thought of

later conjunction. Also, the hedgehoggery of a natural historian must be the most benign form of the affliction that one could devise.

We would have more comfort in our strange and difficult world if we could believe (as our cultural traditions have tried so mightily to impose) that human mentality is the sensible and predictable result of a process directed towards this goal from its inception. (Since human history only graces the last second of the cosmic year, we feel even more driven to identify our inexorable antecedents in earlier history—lest we be forced to confront our status as a fortunate afterthought). Yet history, with its quirky pathways and quixotic reorganizations, teaches a hard lesson. Unless God is even more inscrutable than we ever dared to imagine (or unless He explicitly designed our modes of thought so that we would never grasp His own), the history of life confers no special or preordained status upon human intelligence.

Against this natural assault upon traditional hopes, the hedgehog takes his traditional posture: he rolls up into a ball, nose against anus, and thrusts his prickles against the world. Yet this metaphor, imposed by Archilochus himself, is too harsh and negative. The hedgehog's posture can be joyous and expansive. Like the porcupine of legend, he can aim his darts and strike like Cupid. (Real porcupines do no such thing, and are not closely related to hedgehogs in any case. The world, as I said, is never simple; it doesn't even provide apt metaphors.) The happy hedgehog of this volume roots his posture—and the organization of his essays—into three linked statements about nature and knowledge.

First, nature's way: If life's history cannot be read as an ascending ladder to human wisdom, step after predictable step, neither can the opposite pole of true randomness capture its evident order. Life's history is massively contingent—crucially dependent upon odd particulars of history, quite unpredictable and unrepeatable themselves, that divert futures into new channels, shallow and adjacent to old pathways at first, but deepening and diverging with the passage of time. We can explain the actual pathways after they unroll, but we could not have predicted their course. And if we could play the game of life again, history would roll down another set of utterly different but equally explainable channels. In this crucial sense, life's history does not work like the stereotype of a high-school physics experiment. Irreducible history is folded into the products of time.

Art has often understood this fundamental theme better than science. Marty McFly, trying to preserve the possibility of his own birth, struggles to reunite his parents in *Back to the Future*. In *It's a Wonderful Life* (now in color by coloration, as Frank Capra spins in his grave), the angel grants Jimmy Stewart his request to see how his town would have developed had he never been born. Stewart is astounded by the differences (all negative), and the angel replies that “each man's life touches so many other lives.”

The first two sections of this book group reviews that discuss the irreducibility of history (and the pleasures and challenges of contingency) in its two principal domains of life and the earth. The first section on evolution focuses upon structuralist and historicist alternatives to what I regard as the mistaken functionalist paradigm of adaptation that still shapes Darwinian theory, while (in striking irony) ripping from that theory the very theme—history itself—that defines the subject of life. The second section on geology stresses the importance of narrative and historical uniqueness in

setting a framework for the scientific study of time.

Second, explaining nature's complexity: We have traditionally matched our hopes for linear progress in nature with a mode of scientific explanation well suited to such simple systems: the reductionism of the Cartesian tradition, with its belief that complexity must be broken down (by "analysis") into constituent "atoms" that produce the phenomena of our scale along linear chains of causation regulated by laws of nature. I do not deny the power, or the great successes, of Cartesianism, but hold that its limits have probably been reached in the explanation of complex historical systems. This claim is no appeal to mysticism or intractability, but an argument that equally powerful (but different) techniques of historical *sciences*—with their themes of irreducible interaction, hierarchy, and resolvable contingency—must be embraced to break the hegemony of what, in our parochialism, we call *the scientific method* (the restricted domain of the Cartesian tradition, with its primary themes of experiment, laboratory control, repetition and quantification).

Section three of this book explores the theory and consequences (political and intellectual) of biological determinism, the primary Cartesian account of human nature (tabula rasa environmentalism would be equally reductionist—the issue is one of general explanatory approach, not specific claim). Section four discusses the life and work of four great biologists who struggled with life's contingency: two scientists (McClintock and Just) who based their work upon an intelligible holism rooted in the taxonomic approach to nature, and two representatives of the primary domains of contingency—natural history and medicine (Hutchinson and Thomas).

Third, a general plea for rationalism in explanation: A call against reductionism can attract strange and unwelcome bedfellows. Many people rightly sense the limits of Cartesianism but, still imbued with the cultural and psychological baggage of hope for a transcendent mind, both within our skull and in heaven above, decry rationality itself and make a false equation between the admitted wonder and uniqueness of human mentality and the necessity for mystical explanations that transcend the baseness of material reality. I maintain no hostility towards the hope for new principles in the explanation of mind, but rebel against the perilous slide from our current ignorance to a claim for ineffability (and the even further slide to a glorification of the nonrational). Complex, contingent, interactive, hierarchical do not mean unknowable—quite the reverse, for these are the tools of a different kind of rational understanding. No force can be so powerfully destructive, so capable of undoing the patient struggles of centuries with a single blow, than irrationalism (especially when fueled by the "true belief" that converts such fine concepts as patriotism and religion into dangerous weapons of destruction). Thus, the final section five, "in praise of reason," hovers around the precipice that pushes a rational stance towards complexity (the "New York holism" of my parochial response to Capra) over the edge into false hope, mysticism, and finally demagoguery. I discuss Dyson's pleasant but unsupportable reveries, Jastrow's misreading of evolution in the light of his theological hopes, Capra's flirtation with mysticism, Rifkin's rip-off, and, finally, Gardner's patient and happy sanity.

As a New Yorker who spent summers on Jones Beach and then studied invertebrate paleontology, I have a parochial attachment to creatures of the sea. I always wondered why globular, spiny echinoderms are called "sea urchins." I never

could grasp their affinity with waifs of the city streets—until I discovered that hedgehogs are called urchins in Europe, and that the spiny exterior of these echinoderms does resemble a hedgehog rolled up against danger.

My title—pushing Archilochus even further—tries to capture several aspects of a naturalist’s hedgehogger (also my own background and personality). I stated that themes of antireductionism and historical contingency could define the most benign form of hedgehogger. I say this because such a concept of nature awards the benefits of both the fox’s and the hedgehog’s world: the virtues of consistency in a view of life, with the wondrously diverse products—the veritable storm of results—that an unpredictable contingency places upon our earth. We can revel in all the pretty pebbles for their own sake, while maintaining a coherent view of their estate.

The storm of my title also, and obviously, has a negative meaning—but do remember that the hedgehog’s strategy of enrollment is no retreat or surrender: he presents a tough exterior, continues to prickle the enemy, and unrolls once again into glorious daylight. I do not underestimate the storm at several levels. Yet, as a card-carrying member of the guild of evolutionists, I must assert our primary ethic of valuing diversity in all its guises. Katisha noted that “there is beauty in the bellow of the blast and grandeur in the growling of the gale,” but the sad tale of little tit-willow then melted her hard heart.

# **Evolutionary Theory**

## How Does a Panda Fit?

Many animals, including Jesse James, Alexander the Great, and the giant panda, must, Janus-like, show two faces to the world—one required by legend, the other given by nature. The hortatory faces are, in sequence, honest (in the largest sense), virtuous, and cuddly; the natural visages tend to thievery, rapacity, and ennui.

George B. Schaller and his colleagues, in the finest study yet completed on the second panda, write in their introduction:

There are two giant pandas, the one that exists in our mind and the one that lives in its wilderness home. Soft, furry, and strangely patterned in black and white, with a large, round head and a clumsy, cuddly body, a panda seems like something to play with and hug. No other animal has so entranced the public.... The real panda, however, the panda as it lives in the wild, has remained essentially a mystery.

A review of *The Giant Pandas of Wolong* by George B. Schaller, Hu Jinchu, Pan Wenshi, and Zhu Jing.

*The Giant Pandas of Wolong*, an attempt to decrease the mystery surrounding panda number two, provides extraordinary testimony to another phenomenon, more often part of legend than of fact—international cooperation in science. Only one thousand pandas or so survive in nature, all in six small blocks of bamboo forest (29,500 square kilometers) along the eastern edge of the Tibetan plateau—though historical records indicate a former distribution up to one thousand kilometers further east, nearly to the Pacific coast.

The Wolong Natural Reserve, largest of China's panda sanctuaries, holds between 130 and 150 animals. Chinese scientists began an in-depth study of Wolong pandas in 1978. George B. Schaller, from Wildlife Conservation International, arrived in December 1980 to work with a Chinese team headed by Hu Jinchu of Nanchong Normal College. *The Giant Pandas of Wolong* summarizes the joint work that continues today.

Since this book is about the second panda, it will rarely delight and charm. *The Giant Pandas of Wolong* is a technical treatise, not a contribution to the distinctive genre of popular books that describe a naturalist's intimate life with one interesting species in the wild (including several by Schaller, most notably his *Year of the Gorilla*). We can sense what's coming when we read on, page three (I shall provide a translation upon request) that "the zygomatic arches are spread widely, and the sagittal

crest is prominent.... A typically carnivorous dentition ( $I^3_3 C^1_1 P^4_4 M^2_3 = 42$ , but  $P_1$  may be absent) has been strongly modified for crushing and grinding food.” And the relentless passive voice of conventional scientific prose imparts no charm or grace of composition, especially in such lines as “apparent itches are scratched with fore- or hindpaw.”

Pandas are rare and elusive animals even in the relative abundance of their Wolong reserve. We dare not recognize them as the cute stuffed toys of our children; indeed, we must struggle mightily to see them at all. Between March 1978 and December 1980, Schaller and company saw pandas only sixteen times; the enlarged team recorded thirty-nine additional observations between January 1980 and May 1981. They write: “Most of our contacts were brief—a glimpse as an animal crossed an opening or ambled up a trail.”

Researchers must therefore rely upon indirect methods, primarily two in this case—one old fashioned, the other newfangled. Fortunately, pandas defecate prodigiously, and with such regularity that number of droppings provides an adequate clock for time spent in any particular spot. It is, I suppose, a kind of ultimate dethronement for panda one (of legend) when we recognize that brown cylinders, rather than furry bodies, form the major source of direct evidence for this study.

Schaller and his team then trapped six pandas and fitted them with radio collars. These sophisticated devices transmit different signals during times of activity and rest for pandas. The resulting data on geographic ranges and energy budgets indicate that pandas live in relatively small, well-defined areas, averaging just 4.5 square kilometers for females and 6.1 square kilometers for males, females tending to concentrate their activity within a smaller core area of the range, males roaming more widely.

During most (indeed nearly all) of their day, pandas just don’t do anything calculated to inspire sustained human interest. Basically, they eat bamboo during active periods (about 60 percent of a day) and rest for the remaining 40 percent—all the while emitting the vast undigested bulk of their labor by the rear exit. Other activities—traveling, scent marking, and grooming, for example—consume only a percent or two of an average day. More, of course, happens during the mating season; Darwin’s ultimate game of passing one’s genetic heritage into future generations rarely passes without interest, energy, and (in most cases among animals of our ilk) strife.

In the midst of this bamboo-directed monotony, any peculiar burst of activity must kindle our excitement. Thus, we read with pleasure about the panda that stood on its hands and arched its back end up a tree for scent marking. And we almost shout for joy in learning that one subadult slid downhill (on chest and belly) when it could have walked in snow—and that, *mirabile dictu*, it once walked back uphill to do it again.

And yet, in a sense, I am glad that the life of pandas is so dull by human standards, for our efforts at conservation have little moral value if we preserve creatures only as human ornaments; I shall be impressed when we show solicitude for

warty toads and slithering worms. If we continue to treasure the panda even when we learn that it will not return, in basic human delectation, the warmth and playfulness that we once inferred from its appearance, then we are well on our way to a proper respect for nature. (If we can then come to admire pandas for what they are, and even learn from them some of the lessons that nature's diversity always teaches, then we shall finally understand, and to our greatest benefit in both practical and spiritual terms, what Huxley called, in the language of his day, "man's place in nature.")

Moreover, the very monotony of panda behavior as bamboo-eating machines defines their major interest for evolutionary theory; Schaller's treatment of this central subject also provides my only major unhappiness with his fine book. Pandas, by evolutionary descent, are members of the order Carnivora—but they belie their name by subsisting almost entirely upon bamboo. Their ancestors once ate meat, but then switched to bamboo. By constraint of a heritage so contrary to their current life, pandas must struggle to process enough food. Their digestive apparatus is not well designed for herbivory. Schaller et al. specify three major reasons for the difficulty:

1. Pandas cannot digest bamboo leaves and stems efficiently. "The panda," they write, "has retained the simple digestive tract of a carnivore: it lacks a special chamber to retain food, and it has no symbiotic microbes to ferment cellulose into available nutrients."
2. Pandas must therefore derive nutrients from the easily digestible cellular contents and not from the valuable cell walls. (Pandas defecate so prodigiously because they cannot digest most of what they consume.)
3. Leaves and stems are mostly water and structural carbohydrates; pandas therefore obtain low nutritional return for amounts eaten.

Schaller's calculations show that pandas live on the very edge of sufficiency. They eat bamboo all day long because they must spend every waking hour at it in order to get enough for their low ratio of return to investment. An amusing insight into this marginality arises from Schaller's efforts to determine how many hours a panda must eat (at its observed rate of foraging, speed and size of bite, and value of food) in order to fuel its minimal requirements. His figure of 19.4 hours is impossibly high since pandas only averaged 15.4 hours of eating per day. (This calculation recalls another presented earlier in the book—that pandas defecate more than they eat.) Obviously, these calculations must leave something out (unless pandas subvert the laws of physics). Small increases in speed or bite size (or an occasional munching of two stems at once) would put pandas over their obvious edge of viability. But Schaller's effort does dramatically demonstrate that pandas, though surrounded by food, can barely extract enough from their bounty.

Nonetheless, Schaller's entire discussion proceeds within the prevailing adaptationist model. He interprets everything that pandas do as adaptations to their curious mode of life. He identifies, as the major goal of this study, an understanding of "how the panda is adapted to bamboo." In some trivial sense, of course, pandas are "adapted"—they are getting by. But this sense of adaptation has no meaning—for all animals must do well enough to hang in there, or else they are no longer with us. Simple existence as testimony to this empty use of adaptation is a tautology. Meaningful adaptation must be defined as actively evolved design for local circumstances, not mere muddling through with inherited features poorly suited to current needs.

Pandas do, of course, display a suite of *secondary* true adaptations to their primary, unsurmounted dilemma of trying to eat bamboo with a carnivore's digestive tract. They pick, prepare, and chew with efficiency that has actively evolved; they have even invented a famous false "thumb" to abet their struggle.<sup>1</sup> But surely, despite the conceptual cloak cast by adaptation over this book, the primary theme of panda life must be read as a shift of function poorly accommodated by a minimally altered digestive apparatus. When anatomical structures are co-opted for new functions from previous uses in a different past, we may not speak of adaptation. When, as with pandas, the co-opted organs work so precariously, appeals to adaptation are even less appropriate.

When, in unguarded moments, Schaller lets the conceptual blinders slip, he reports the panda's dilemma forcefully: "The longer food remains in the digestive tract, the more fully will it be utilized; thus a long intestine, as found in herbivores, might benefit the panda.... The panda's digestive tract lacks physical and physiological adaptations for processing a bulky, herbivorous diet." (Deer intestines may be fifteen times longer than their body, sheep twenty-five times; pandas rank with other carnivores in having intestines only four to seven times as long.) But allegiance to adaptation soon usurps any subtle discussion of history, and we return to Gleason's mode—"how sweet it is." The authors even argue that the wild panda's failure to accumulate body fat should be viewed as an adaptation to their stable food supply. (They mention that zoo pandas do store fat, so physiology does not preclude obesity.) Might I suggest the obvious alternative—that a little fat might be a good thing, but that pandas, eating all their waking day simply to get by, remain slim by constraint rather than design.

The debate about adaptation is not a petty, abstract nicety of academic life. It embodies our basic attitudes toward history. Evolutionary biology is the primary science of history; strict adaptationism, ironically, downgrades history to insignificance by viewing the organism's relation to environment as an isolated problem of current optimality. How inappropriate to clamp this conceptual lock upon the panda—a demonstration, if ever one existed, that past histories exert a quirky hold (through inefficiencies imposed by heritage) upon an imperfect present.

Writing so brilliantly about the hold of theory upon our ability to observe, Geoffroy Saint-Hilaire<sup>2</sup> stated in 1827: "At first useless, these facts had to remain

unperceived until the moment when the needs and progress of science provoked us to discover them.” It is time to rescue history from the subverting power of Pangloss’s spectacles.

Everyone knows that the panda’s current plight extends well beyond the intrinsic dilemma of its unbreakable contract with bamboo (intensified by the tendency of most bamboo species to undergo mass flowering with subsequent death of edible plants and long periods of no food until new seedlings grow). People have relentlessly cut the forests and driven pandas into ever-smaller natural areas in this land of more than a billion human inhabitants. Chinese authorities, pushed by world opinion and their own affection for pandas, have responded admirably, but ever so late. The giant panda will probably survive, marginally in its few natural reserves, more dependably in zoos.

We will probably save most of the large species that interest or amuse us (we will lose—are losing at an accelerating pace—untold numbers of smaller, unnoted creatures). But salvation will not be in nature. Zoos are changing their function from institutions of capture and display to havens of preservation and propagation. We may applaud this revolution in concept, and we rejoice in the success of so many breeding programs. Yet the near certainty that most conspicuous species—like the panda—will survive only under human management fills me with sadness. Some of the reasons are practical—the problems of inbreeding, the disappearance of geographic variation as a subject for evolutionary study. But the primary reason is deeper, and hard to express. “Natural” and “artificial” represent a dichotomy not easily breached in human attitudes. An animal outside its appropriate historical place loses more than a home. When the Shunammite woman built a room for Elisha and furnished it with bed, table, stool, and candlestick, the holy man asked, “what is to be done for thee? wouldest thou be spoken for to the king?” (2 Kings 4:13). She replied, with beautiful conciseness, that she wanted nothing, for she lived in greatest satisfaction: “I dwell among mine own people.”

On the subject of biblical metaphor, please do not forget that Elisha arranged for her to conceive a son nonetheless, and later raised him from the dead. Good luck to the panda.