The Tallest Tale

Is the textbook version of giraffe evolution a bit of a stretch?

By Stephen Jay Gould

As a scholarly devotee of armchairs and ivory towers, I shall begin with two strikingly similar legends about standing up at events designed for sitting. In high culture’s version, the audience rises at the opening chords of the “Hallelujah Chorus” and remains standing throughout the piece. (Choral singers—I am one—love the ritual, for we thereby obtain our only guaranteed standing ovation. The intermission after part two of Handel’s Messiah directly follows this great chorus.) In pop culture’s primary example—the seventh-inning stretch—fans by the thousands stand before their team comes to bat in the seventh inning of a baseball game. (The effect is almost eerie. No one makes any announcement, and an unruly crowd behaves, for this one moment, as an entity. Countless fathers have taken advantage of this ritual by telling gullible children at their first ballgame: “I can make the entire audience stand at my command”—and then issuing the appropriate order just before the predictable response. Has any kid ever been tricked into obedience by believing that “father sees all”?)

Although names and places vary maximally, we tell exactly the same (undoubtedly false) story to explain each ritual. An English king (someone between George II and George IV, depending on your favored version) was so moved by Handel’s majestic music that he stood in honor—and audiences have done so ever since. An American president (William Howard Taft by consensus) got up to stretch his legs, and everyone else rose to honor the office.

I love these tales because, in more reasonable attributions of motive, they so beautifully embody a fundamental theme of historical explanation—that consequences of substantial import often arise from trivial triggers of entirely different intent. In other words, current utility bears no necessary relationship with historical origin. Who knows why good king George—the-whatever stood up? Maybe he thought the intermission had already come. Maybe he was bored or wanted to go out for a smoke. As for Taft, he probably got up to leave early (some versions even recount the story this way). Has any president ever stayed for an entire game? But think of the aggregated consequences ever since—millions upon millions of people standing at the appointed time. Gazillions of joules of spent energy. All manner of secondarily accreting traditions, as people who never otherwise sing outside the shower, for example, lustily exclaim, “Take me out to the ballgame.” And all because a king or a president once tried to sneak out early or slip out for a pee. Substantial consequences from utterly insignificant origins.

I raise this theme because I recently realized that the primary “old standard,” the classic textbook illustration of our preferences for Darwinian evolution, arose in the same manner—as an entrenched and ubiquitous example based on an assumed weight of historical tradition that simply does not exist. In connection with a much earlier essay in this series (January 1988, on the knee-jerk textbook comparison of earliest fossil horses with modern fox terriers in size), I made a survey of all major high-school textbooks in biology. Every single one—no exceptions—began its chapter on evolution by first discussing Lamarck’s theory of the inheritance of acquired characters, and then presenting Darwin’s theory of natural selection as a
preferable alternative. All texts then use the same example to illustrate Darwinian superiority—the giraffe's neck.

Giraffes, we are told, got long necks in order to browse the leaves at the tops of acacia trees, thereby winning access to a steady source of food available to no other mammal. Lamarck, the texts continue, explained the evolution of long necks by ar-
A highly readable account of one of the only taboo subjects left in our society.

Death to Dust: What Happens to Dead Bodies? by Kenneth V. Iserson, M.D. is about the unseen after-death activities that go on within our living world. It presents answers to the questions everyone wants to know but will not ask. What happens in embalming, cremation, cryogenic preservation, autopsies, organ donation, and funerals? What does the medical examiner really do? How about the more bizarre uses of corpses, such as cannibalism, use for secret rites, research and religious ceremonies? Never before has there been such a comprehensive book on the subject—written for the professional and layman alike. This book sheds light into dark corners of our society and proves that, once again, truth is stranger than fiction. 705pp. HC

ORDER TOLL-FREE 1-800-THE BOOK
24 Hours A Day, 7 Days A Week— Mention Code D216 to the operator
Fax/Te: 1-201-767-9169 OR MAIL THIS COMPLETED COUPON

Barnes & Noble

Barnes & Noble Books—By-Mail, Dept. D216, 1 Pond Road, Rockleigh, NJ 07647

Yes, please rush me ___ copies of Death To Dust, (B106772) at $29.95 ea. Add tax for delivery in CA, CT, MA, MI, MN, NJ, NY, PA, plus $3.00 for shipping and handling. (NY and PA laws require that the figure by which the tax is calculated must include the shipping and handling charge.) The price of $29.95 is available by mail-order only.

Payment method: [ ] Check [ ] MC [ ] Visa [ ] Discover [ ] American Express [ ] Diners Club
Card No. ____________________________ Exp. Date (mm/yy) ____________________________
Signature ____________________________________________________________
Name ______________________________________________________________________
Address ____________________________________________________________________
City ____________________________ State ____ Zip __________

Certified Genuine Ancient Roman Emperor Coins

Each coin is attributed by emperor

ONLY $19 EACH

Five Different Emperors, $89

Up to 2,000 years old, these authenticated Roman bronze coins are fascinating "windows" on the glorious days of the Caesars and the vast Roman Empire. Each has been individually attributed by emperor with dates of reign. Obverses display sculptured portraits of emperors and empresses; reverses show family members, deities, rites, animals, religious symbols. They're at least 1,600 years old. Each is guaranteed to be in Very Good quality and comes in a protective transparent holder with identification and certificate of authenticity. Only $19 each (order #18482). Five different types, $89 (18483). Add $2 postage and handling. 30-Day Home Examination: Money-Back Guarantee. To order by credit card, call toll-free. Or send a check or money order to:

International Coins & Currency
62 Ridge St., Box 3423, Montpellier, VT 05601
1-800-451-4463
Serving collectors for 22 years 3423

guaging that giraffes stretched and stretched during life, elongated their necks in the process, and then passed these benefits along to their offspring by altered heredity.

This lovely idea may embody the cardinal virtue of effort rewarded, but heredity, alas, does not operate in such a manner. A neck stretched during life cannot alter the genes that influence neck length—and offspring cannot reap any genetic reward from parental striving. We therefore prefer the Darwinian alternative, consistent with the Mendelian nature of heredity, that giraffes with fortuitously longer necks (in a varying population with a large range of neck lengths among individuals) will tend to leave more surviving offspring that inherit their genetic propensity for greater height. This slow process, continued for countless generations, can lead to a steady increase in neck length, so long as local environments continue to favor animals with greater reach for those succulent topmost leaves.

We often symbolize movements and beliefs by icons of clear meaning based on shared cultural histories. Thus, Americans may proclaim political affiliations by sporting a pin with a donkey or an elephant. More specifically, and among donkeys, a button with nothing but a saxophone identified "Friends of Bill" in the last presidential election, just as a pin of a shoe with a hole (recalling a famous photo of a tired candidate) once rallied the supporters of Adlai Stevenson. Similarly, the tallest of mammals, sticking its neck up, stands for evolution, and particularly for Darwin’s mechanism of natural selection. When Francis Hitching wrote a recent iconoclastic book, for evolution but against Darwinism, he chose as his title The Neck of the Giraffe—even though his text barely mentions the creature.

A story so often repeated should rise from firm foundations and bear both strong and graceful support throughout the length of construction. In short, this most familiar of all examples should, like the subject's own head, stand tall above everything else, buttressed by a device as supple and as well designed as the neck of the giraffe. Or, to recall the second image of my opening sentence, and to quote from the greatest of all love poems (called,
not inappropiately, the Song of Songs): “Thy neck is like a tower of ivory. . . . Thy stature is like a palm tree.”

If, instead, we traced this ubiquitous example back to scraps of speculation and discovered either no foundation at all or a funny little point of origin equivalent to a king in need of a bathroom break, then we might learn two lessons of potential import: first, that repetition need not correlate with truth value and that even the most pious certainties should be periodically scrutinized right down to their foundations; and second, that the current importance and utility of a phenomenon gives us no particular insight into the circumstances of its historical origin.

When we look to presumed sources of origin for competing evolutionary explanations of the giraffe’s long neck, we find either nothing at all or only the shortest of speculative conjectures. Length, of course, need not correlate with importance. Garulous old Polonius, in a rare moment of clarity, reminded us that “brevity is the soul of wit” (and then immediately vitiated his wise observation with a flood of woolly words about Hamlet’s madness). Many of the most famous Bible stories occupy only a verse or two, while lists of laws and begats go on for pages.

Yet length must bear at least a rough relationship to perceived depth of meaning. Few authors will write chapters on matters deemed trivial and then devote only a line to their own most treasured theme—if only because readers will then be unable to weigh the relative importance properly. I feel quite confident that the authors of the Old Testament did grant greater meaning to their genealogies and laws—the basis of order and power in their own society, after all—than to the story of Jonah and the whale (the shortest chapter in one of the Bible’s shortest books). Our contemporary inversion—for fish stories now trump long lists of begats for unknown people with unpronounceable names—merely illustrates my chief point that current utility must be separated from historical origin in any judgment of importance or meaning.

The giraffe’s neck just wasn’t a big issue for the founders of evolutionary theory—not as a case study for arguing about alternative mechanisms, not for anything much at all. No data from giraffes then existed to support one theory of causes over another, and none exist now. I admit that absence of data rarely stops an imaginative scientist from speculating, but you can generate just so many words before a paucity of information dries up your thoughts. And let us hope that no decent natural historian will use a speculative case as a primary illustration of a central theory.

Lamarck did mention giraffes’ necks as a putative illustration of evolutionary enlargement by the inherited effects of lifetime effort. But his entire discussion runs for one paragraph in a chapter filled with much longer examples that he obviously regarded as far more important. Lamarck had this—and absolutely nothing more—to say about giraffes’ necks, a few lines of speculation never intended as the centerpiece of a theory:

It is interesting to observe the result of habit in the peculiar shape and size of the giraffe: this animal, the tallest of the mammals, is known to live in the interior of Africa in places where the soil is nearly always arid and barren, so that it is obliged to browse on

---

**Québec**

Your next great vacation is closer than you think.

**Québec '96**

Summer & Fall Vacation Packages


Ask for your FREE Summer and Fall Vacation Packages brochure on neighbourly Québec. Vibrant cities, scenic resorts, fabulous countryside. Fascinating museums and festivities.

Call 1 800 363-7777 (Operator 104)

9 am to 5 pm, 7 days a week for a free brochure and a genuine Bonjour, or call your travel agent or your AAA Club.

Send e-mail to: info@tourisme.gouv.qc.ca.

---

**Québec**

THE WORLD NEEDS MORE CANADA

---

**Québec**

P. O. Box 98
Plouër Point
NY 12097-9957

---

**Québec**

Please send me my FREE 1996 Summer and Fall Vacation Packages brochure on neighbourly Québec.

NAME: ____________________________
ADDRESS: ________________________
CITY: ____________________________
STATE: ____________________________
ZIP CODE: ________________________

Mail to: Tourisme Québec
P. O. Box 98
Plouër Point
NY 12097-9957

---

**Québec**
the leaves of trees and to make constant efforts to reach them. From this habit, long maintained in all the individuals of the race, it has resulted that the animal’s forelegs have become longer than its hind legs and that its neck is lengthened to such a degree that the giraffe, without standing up on its hind legs, can raise its head to a height of six meters. (From Lamarck’s classic 1809 work, Philosophie zoologique, vol. 1, p. 122, my translation.)

The above paragraph contains a giveaway statement—but you have to know the eighteenth-century literature to spot the clue—proving that Lamarck cared little about giraffes, and therefore didn’t grant this throwaway example much weight. Giraffes had not often been housed in European zoos—mostly private collections of royal patrons at the time—but travelers had seen them in the wild, and many visitors had viewed giraffes on display in Cairo. Giraffes had been known to Europeans since classical times, when Julius Caesar included them in public slaughters at the Colosseum.

Some reports had claimed, as Lamarck affirms, that the giraffe’s front legs greatly exceeded the back legs in height. In fact, both pairs of legs are equally tall. The impression of greater frontal height arises from the pronounced rearward slope of the giraffe’s back, a consequence of the massive muscles and spinal projections needed up front to support the huge neck. The most reliable sources available in Lamarck’s day had adequately established the equal height of fore and rear legs and had dismissed the old myth of superior frontal elongation. Thus, if Lamarck repeated the old legend in his single paragraph about giraffes, he couldn’t have read the literature thoroughly.

The example gained no particular steam as English writers explained Lamarck’s theory to their countrymen. Lyell’s remarkably fair exposition in opposition—given in the second volume of his Principles of Geology in 1832 and the source of most early English contact with Lamarck’s theory—quoted the example in abridgment and made no further comment. In his famous series of lectures to working men (On Our Knowledge of the Causes of the Phenomena of Organic Nature), published in 1863 as the first great popular exposition of Darwinism, T. H. Huxley omitted giraffes entirely and illustrated Lamarck’s theory with two examples emphasized by the Frenchman himself: the blacksmith’s strong right arm, putatively inherited by his sons, and the long legs and webbed feet of shorebirds, presumably evolved to avoid submersion or slapping in muddy ponds or flowing waters.

When we turn to the horse’s mouth, the first edition of Darwin’s Origin of Species (1859), we find no mention whatever of the giraffe’s neck as an illustration of natural selection. Interestingly—and proving my point with panache—Darwin does cite the giraffe in just the context usually assumed for the legend of the neck: as a speculative story about the efficacy of natural selection. But in this passage, Darwin considers the giraffe’s opposite end and tells a tale about the tail. Moreover—because Darwin did not much favor the fabulous “just-so story” mode for illustrating natural selection by plausible speculation alone—his story about the giraffe’s tail occupies only a passing paragraph.

Darwin invokes the giraffe’s tail to contend that natural selection has sufficient power to explain “organs of trifling importance.” The giraffe’s tail, he argues, works primarily as a fly swatter. One might regard such a function as too trivial to fall under the purview of a mechanism based on differential survival (can swatting flies really become a matter of life or death?). Darwin replies:

The framework of bones being the same in the hand of a man, wing of a bat, fin of the porpoise, and leg of the horse,—the same number of vertebrae forming the neck of the giraffe and of the elephant,—and innumerable other such facts, at once explain themselves on the theory of descent with slow and slight successive modifications.

In his subsequent and longest book, the two-volume Variation of Animals and Plants Under Domestication (1868), Darwin does finally introduce the giraffe’s neck in a discussion of natural selection. But again, and ironically given the later codification of the case as our canonical just-so story in the speculative tradition, Darwin does not cite the neck of the giraffe to tell a tale about presumed adaptive advantages. Rather, he raises the example to discuss a more subtle issue central to the validity of natural selection as a general explanation of evolution.

Even if we assume that the giraffe’s neck evolved as an adaptation for eating high leaves, how could natural selection build such a structure by gradual increments? After all, the long neck must be associated with modifications in nearly every part of
the body—long legs to accentuate the effect and a variety of supporting structures (bones, muscles, and ligaments) to hold up the neck. How could natural selection simultaneously alter necks, legs, joints, muscles, and blood flows (think of the pressure needed to pump blood to the giraffe’s brain)? In response to this problem, some critics had proposed that all relevant parts must be changed together in one fell swoop. Such suddenly coordinated modification would invalidate natural selection as a creative force because the desired adaptation would then arise all at once as a fortuitous consequence of internally generated variation. (Moreover, Darwin adds, we have no evidence for a deus ex machina of such complexly coordinated variation—and the whole proposal smacks of desperation and special pleading.)

Darwin provides a cogent and subtle explanation (perhaps not thoroughly satisfactory by current views, but entirely logical and coherent). Interestingly, his proposal embodies the theme of this essay—the need to dissociate current utility from historical origin. A giraffe’s current functioning may require coordinated action of all parts that support the long neck, but these features need not have evolved in lock step. If the neck grows by ten feet all at once, then every bit of supporting anatomy must be in place. But if the neck elongates by only an inch at a time, then the full panoply of supporting structures need not arise at every increment. The coordinated adaptation can be built piecemeal. Some animals may slightly elongate the neck, others the legs; still others may develop stronger neck muscles. Through sexual reproduction, the favorable features of different organisms may be combined in offspring.

In developing this general explanation by using the giraffe as a putative example, Darwin does engage in conjectural biology. But I would defend this mode of speculation as a device utterly different from telling fatuous stories. When scientists need to explain difficult points of theory, illustration by putative example—rather than by total abstraction—works well (perhaps indispensably) as a rhetorical device. Such cases do not function as "speculations" in the pejorative sense—as silly stories that provide no insight into complex mechanisms—but rather as idealized illustrations to exemplify a difficult point of theory. (Other fields, such as philosophy and the law, use such conjectural cases as a standard device.)

In thus invoking the giraffe, Darwin does embed a line within his text about adaptive advantages of reaching high. Taken out of context, this comment could be read as a premonition of silly speculations to come. But its role as part of a conjectural case to illustrate a subtle and complex point of theory should be clear in the following totality (from Darwin’s 1868 book, vol. 2, pp. 220–21):

With animals such as the giraffe, of which the whole structure is admirably coordinated for certain purposes, it has been supposed that all the parts must have been simultaneously modified; and it has been argued that, on the principle of natural selection, this is scarcely possible. But in thus arguing, it has been tacitly assumed

(Please turn to page 54)
(Continued from page 23)
that the variations must have been abrupt and great. No doubt, if the neck of a
ruminant were suddenly to become greatly
elongated, the fore limbs and back would
have to be simultaneously strengthened and
modified; but it cannot be denied that an
animal might have its neck, or head, or
tongue, or fore-limbs elongated a very little
without any corresponding modification in
other parts of the body; and animals thus
slightly modified would, during a death,
have a slight advantage, and be enabled to
browse on higher twigs, and thus survive.
A few months' more or less every day would
make all the difference between life and
death. By the repetition of the same process,
and by the occasional intercrossing of the
survivors, there would be some progress, slow
and fluctuating though it would be, towards
the admirably coordinated structure of the
giraffe.

I suspect that the giraffe's neck first be-
came an explicit and contested issue within evolutionary theory when St.
George Mivart, a fascinating rebel in many
ways (a devout Catholic in an Anglican
land, and an evolutionist firmly opposed to
the mechanism of natural selection), pub-
lished his 1871 critique of Darwinism, The
Genesis of Species. Mivart did focus on the
giraffe's neck, and he did present Darwin's
supposed case in the form that has become
canonical in modern high-school text-
books—that is, as a speculative tale about
natural selection. But note that Mivart
wrote to oppose Darwinism, and that ene-
mies tend to caricature and trivialize the
doctrines they attack. Mivart stated:

At first sight it would seem as though a
better example in support of "Natural
Selection" could hardly have been chosen.
Let the fact of the occurrence of occasional,
severe droughts in the country which that
animal has inhabited be granted. In that
case, when the ground vegetation has been
consumed, and the trees alone remain, it is
plain that at such times only those
individuals (of what we assume to be the
nascent giraffe species) which were able to
reach high up would be preserved, and
would become the parents of the following
generation.

For the sixth and last edition of the Origin
of Species (1872), Darwin added the
only chapter ever appended to his book—
primarily to refute Mivart's attack. This
new chapter does discuss giraffes exten-
sively (although only to rebut Mivart) and
may be a primary source for the legend as
later developed (for almost all reprints and
subsequent versions, up to our own day,
feature this sixth edition, and not the
first edition of 1859, which did not men-
tion giraffes’ necks in the context of natu-
ral selection at all).

When we read Darwin's careful words,
however, we encounter yet another irony
in our expanding list. The giraffe's neck
supposedly supplies a crucial example for
preferring natural selection over Lamarck-
ism as a cause of evolution. But Darwin
himself (however wrongly by later judg-
ment) did not deny the Lamarckian prin-
ciple of inheritance for characters acquired
by use or lost by disuse. He regarded the
Lamarckian mechanism as weak, infre-
quent, and entirely subsidiary to natural
selection, but he accepted the validity of
evolution by use and disuse. Darwin does
speculate about the adaptive advantage of
giraffes' necks, but he cites both natural
selection and Lamarckism as probable causes
of elongation. Thus, obviously, Darwin
never regarded giraffes' necks as an illustra-
tion for the superiority of natural selection
over other valid mechanisms. He writes in
two passages of the 1872 edition, marrying
Lamarck with natural selection:

By this process [natural selection] long
continued . . . combined with the inherited
effects of the increased use of parts, it seems to me
almost certain that an ordinary hoofed
quadraped might be converted into a giraffe.

In every district some one kind of animal will
almost certainly be able to browse higher than
the others; and it is almost equally certain
that this one kind alone could have its neck
elongated for this purpose, through natural
selection and the effects of increased use.

We may summarize the main line of this
meandering tale as a list of five ironies,
technically defined as statements where,
for humorous or sarcastic effect, the in-
tended meaning of words is opposite to
their usual sense—as in "that's very smart"
for a proposal you regard as consummately
dumb. In this story, none of the five his-
torical facts arose for ironic intent. The
irony occurs retrospectively, for each fact
subverts the legend that "everyone knows"
about tall giraffes—namely, that long
necks for high leaves provides a splendid il-
ustration for the superiority of Darwinian
natural selection over Lamarckian use and
disuse. The joke, in other words, is on the
silly canonical legend as recounted in all
modern textbooks.

1. Lamarck mentions giraffe necks in one
passing paragraph of speculation
within a chapter devoted to much longer
examples regarded as far more important.

2. Darwin does not cite the case at all in
the first edition of the Origin of Species. He
does tell a giraffe story in the just-so mode,
but from the body's opposite end—the tail
rather than the neck. Darwin's only quick
phrase about giraffe necks illustrates the
opposite theme of inherited stability
(retained number of neck vertebrae), rather
than novel adaptation.

3. When Darwin, in his longer and
more technical book of 1868, does discuss
giraffe necks in the context of natural
selection, he does not present the standard
just-so story of pure speculation, but
rather uses giraffes to exemplify the diffi-
cult and crucial issue of how gradualist
natural selection can build a complex
adaptation of many coordinated parts (the
neck and all the supporting structures).

4. Mivart, in attempting to refute Dar-
winism, tells the just-so story that would
become traditional, but he does so to car-
icature a theory he opposes.

5. When Darwin responds to Mivart in
the last edition of the Origin of Species, he
does interpret giraffe necks as adaptations
for feeding on high leaves, but he argues
that natural selection worked in concert
with Lamarckian forces! (So much for a
"classic" illustration of why the giraffe's
neck leads us to prefer Darwin over
Lamarck.)

I don't know (but would love to find
out) how and where the legend's modern
form originated in such striking contrast
to alleged historical sources. Henry Fair-
field Osborn, the dominant paleontologist
of his era, and longtime director of the American Museum of Natural History, gave the “standard” version in his popular book _The Origin and Evolution of Life_ (1918):

The cause of different bodily proportions, such as the very long neck of the tree-top browsing giraffe, is one of the classic problems of adaptation. In the early part of the nineteenth century Lamarck attributed the lengthening of the neck to the inheritance of bodily modifications caused by the neck-stretching habit. Darwin attributed the lengthening of the neck to the constant selection of individuals and races which were born with the longest necks. Darwin was probably right.

This version has held ever since. Readers may well ask why we should devote energy to tracing such historical arcana. Why not let sleeping dogs lie and silly legends propagate, especially if tall tales do no harm? I gave some theoretical reasons for interest earlier in this essay, but I also wish to stress a practical concern. If we choose a weak and foolish speculation as a primary textbook illustration (falsely assuming that the tale possesses a weight of history and a sanction in evidence), then we are in for trouble—as critics properly nail the particular weakness and then assume that the whole theory must be in danger if supporters choose such a fatuous case as a primary illustration. For example, in his anti-Darwinian book cited earlier (and eponymously named _The Neck of the Giraffe_), Francis Hitching tells the story in the usual form:

The evolution of the giraffe, the tallest living animal, is often taken as classic evidence that Darwin was right and Lamarck wrong. The giraffe evolved its long neck, it is said, because natural selection chose those animals best able to feed off the highest treetops, where there is most food and least competition.

Hitching then adds: “The need to survive by reaching ever higher for food is, like so many Darwinian explanations of its kind, little more than a post hoc speculation.” Hitching is quite correct, but he re-

buts a fairy story that Darwin was far too smart to tell, but that entered our high-school texts as a classic case nonetheless. Eternal vigilance, they say, is the price of freedom. Add intellectual integrity to the cost basis.

As a closing point, we might excuse this thoughtless repetition of an old legend without presumed historical sanction if later research had established the truth of the tale nonetheless. But when we turn to giraffes themselves, we encounter the final irony of this long story. Giraffes provide no established evidence whatsoever for the mode of evolution of their undeniably useful necks.

All giraffes belong to a single species, quite separate from any other ruminant mammal, and closely related only to the okapi (a rare, short-necked, forest-dwelling species of central Africa). Giraffes have a sparse fossil record in Europe and Asia, but ancestral species are relatively short necked, and the spotty evidence gives no insight into how the long-necked modern species arose. (_The Giraffe: Its Biology, Behavior and Ecology_, by A. I. Dagg and J. B. Foster, published in 1976, gives an excellent and thorough account of all major aspects of giraffe biology.)

When we study the function of long necks in modern giraffes, we encounter an embarass de richesses. Almost anything important in the life of a giraffe involves some use of the remarkable neck. Giraffes surely employ their long necks (and their long legs, long faces, and long tongues) to reach high-growing acacia leaves. Giraffes thereby browse several feet of vegetation exploitable by no other ground-dwelling mammal. The champion giraffe reached an astonishing nineteen feet, three inches in height. Groves of African acacia trees (I have seen this phenomenon in the field) are often denuded below a sharp line representing the highest reach of local giraffes, but their bony horns atop the head can inflict consider-

But giraffes also use their necks for other prominent and crucial activities. Male giraffes, for example, establish dominance hierarchies by frequent and prolonged bouts of “necking,” or swinging their large neck into the body of an opponent. These contests are more than merely symbolic, as the long neck propels the head with substantial force, and the bony horns atop the head can inflict consider-

The tale is a fairy story that Darwin was far too smart to tell, but that entered our high-school texts as a classic case nevertheless.

Dagg and Foster describe a bout between two males named Star and Cream:

_The two bulls . . . stood side by side, head to tail, close together, each with his legs apart under him for balance. Suddenly Star lowered his head and whipped it, horns foremost, at Cream's trunk, connecting with an impact that was heard easily from 40 meters away. Cream lurched sideways, collected himself and returned the blow with his head, striking Star on the neck. Star then aimed at Cream's front legs and knocked them out from under him with a blow of his head._

Dagg and Foster describe potential outcomes:

_The losing giraffe in such a struggle does not always escape so easily. His head may be gashed during a fight or he may be knocked to the ground unconscious. . . . In such a contest in the Kruger National Park one of the contestants was killed. He had a large hole immediately behind one ear where his top neck vertebra had been splintered by a blow; part of the splinter had pierced the spinal cord._

Interestingly, giraffes fight predators (primarily lions) by kicking, but their sexual combats proceed by necking, never by kicking. Thus, this function of the neck seems to represent a specifically evolved
behavior for a particular circumstance.

Giraffes also use their neck in several other ways: as a “look-out tower” to spot predators and other dangers, and as a device to increase surface area and shed heat (giraffes, unlike almost all other large African mammals, do not seek shade and can remain in the sun). Both these functions have been viewed by prominent scientists as a chief reason for the evolution of long necks. In addition, giraffes deftly shift their center of gravity by appropriate movements of the neck—and these maneuvers are crucial to a wide range of activities, including rising from a lying position, running, and climbing fences and other barriers.

We may now return to the central theme of this essay—the dissociation of current utility from historical origin—and understand why the giraffe’s neck cannot provide a proof for any adaptive scenario, Darwinian or otherwise. Giraffes do indeed use their long neck to browse leaves at the tops of acacia trees—but such current function, no matter how vital, does not prove that the neck originally evolved for this purpose. The neck may have first lengthened in the context of a different use, and then been co-opted for better dining when giraffes moved into the open plains. Or the neck may have evolved to perform several functions at once. We cannot know the reasons for historical origin by listing current uses.

When we consider the full range of current functions, we can be fairly confident that some uses must be secondary, and therefore cannot be the source of historical origin. I can’t imagine, for example, that long necks evolved to help giraffes maneuver in running, jumping, and getting up—because the problem only arose when giraffes acquired a long neck in the first place, and solutions to problems can’t be sources of the problem.

But other functions may well be original—and the famous reaching for leaves could arise as a largely secondary effect. Since natural selection works fundamentally by differential reproductuve success, and since sexual combat among males so often acts as a primary determinant of such Darwinian benefit, we could state a plausible case for regarding sexual success as the chief adaptive reason for evolving a long neck, with the much vaunted browsing of leaves as a distinctly secondary consequence. In short, we have no basis for any firm assertion about the most famous inquiry among Darwinian just-so stories: how did the giraffe get its long neck?

This essay therefore features a double whammy in pursuit of a primary theme—the dissociation of current utility from historical origin. In the realm of ideas, current use of the giraffe’s neck as the classic case of Darwinian evolution does not grow from firm and continuous historical roots. The standard story, in fact, is both fatuous and unsupported. In the realm of giraffes, current use of maximal mammalian height for browsing leaves does not prove that the neck evolved for such a function. Several reasonable alternative scenarios exist, and we have no evidence for preferring any plausible version over another. *Caveat lector.*

Why then have we been bamboozled into accepting the usual tale without questioning? I suspect two primary reasons: we love a sensible and satisfying story, and we are disinclined to challenge apparent authority (such as textbooks). But do remember that most satisfying tales are false. The seventh-inning stretch predicted Mr. Taft, and the story of kingly rising before the “Hallelujah Chorus” has no established foundation either. Polonius may have been an old bore, but he did give some good advice to his son in the famous speech that Laertes surely failed to process because he was trying so hard to leave town. Among other tidbits, Polonius emphasized the importance of overt appearance—and we would do well to remember his counsel. Darwinian evolution may be both true and powerful, but if we continue to illustrate our conviction with an indefensible, unsupported, entirely speculative, and basically rather silly story, then we are clothing a thing of beauty in rags—and we should be ashamed, “for the apparel oft proclaims the man.”

Stephen Jay Gould teaches biology, geology, and the history of science at Harvard University. He is also Frederick P. Rose Honorary Curator in Invertebrates at the American Museum of Natural History.