



# Through a Glass Brightly

Using Science to See Our Species  
As We Really Are

David P. Barash

# Advanced Praise for *Through a Glass Brightly*

“A ruthless and witty debunking of self-flattering illusions held by man over millennia that nonetheless leaves the reader feeling oddly hopeful, and almost giddy. Who knew science could be so much fun?”—Rick Shenkman, author of *Political Animals: How Our Stone-Age Brain Gets in the Way of Smart Politics*.

“A refreshing, revelatory and poignant look at the fundamental faults of our species, that also explains our inability to make the bold decisions ensuring the long-term survival of planet Earth. A must-read for anyone who struggles to comprehend our species and its disregard for the natural world and the impact and consequences of our collective and wasteful existence.”—Louise Leakey, Paleontologist and Research Professor, Turkana Basin Institute, Stony Brook University.

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“There could hardly be a more timely and urgent issue than the role of scientific inquiry in determining what makes humans human and our proper place in and relationship

to nature. In lucid prose that explains the scientific method to anyone who cares about the difference between facts and fantasy, David Barash explores the psychological, social, and physical perils that are inevitable when human beings regard themselves as being above nature rather than a part of nature. This is a splendid tribute to a human specialness that depends not on having been created by a divine being but on our willingness to use reason to deal wisely with the rest of nature. Every literate politician in Washington should read this book.”—Susan Jacoby, author of *The Age of American Unreason in a Culture of Lies*.

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“This engaging, energizing and enlightening treatise on man’s place in nature goes a long way towards reminding all humanity that we are part of the natural world. But it issues a warning as well: if modern humans continue to ignore this simple fact, it will be at our peril.”—Donald C. Johanson, Discoverer of “Lucy” and Founder of the Institute of Human Origins, Arizona State University.

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Species as We Really Are

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# **Through a Glass Brightly**





**Part I**

**The Allure of Human  
Centrality, or, How We  
Persistently Try to Deny  
Our Place in the Natural  
World—and Fail**

# Prelude to Part I

**BEING KICKED OUT** of paradise must have been tough on Adam and Eve. The requirement to earn food by the sweat of their brow was doubtless bad enough, not to mention pain in childbirth, but losing immortality and being told that dust they are and to dust will they return, must have been—in modern parlance—a real bummer.<sup>a</sup>

In any event, those particular losses happened long ago, so no one around today has directly experienced the trauma. By contrast, in recent time we human beings have been deprived of some of our most beloved and comforting Edenic myths, with others dropping out almost daily, leaving us to confront a growing array of paradigms lost, many of them variants on this fact, easy to state, hard to accept: we are not as important, as special, as all-around wonderful as we'd like.

Confronting this reality—more accurately, trying to negotiate around it—engages a deep-rooted tendency whereby people begrudgingly accept what is forced on them, while nonetheless clinging to their most cherished preexisting beliefs, what they *want* to be true. Prominent current cases include granting that the Earth's climate is heating up but refusing to accept that human beings are responsible, or acknowledging that evolution is real when it comes, for example, to microbial antibiotic resistance but denying that it produced us.

It is an inclination that is evidently deep-rooted in the human psyche. Thucydides, fifth-century BC historian of the Peloponnesian War, complained of his contemporaries that “their judgment was based more upon blind wishing than upon any sound prevision; for it is a habit of mankind to entrust to careless hope what they long for, and to use sovereign reason to thrust aside what they do not fancy.”

It is difficult to modify an opinion once established, especially if it's a favorable one—and even more so if it is centered on one's self (or one's species). A particular consequence of intellectual progress has nonetheless been an understanding of our increasingly deflated place in nature and in the universe, making it more and more

<sup>a</sup> As a biologist, I confess to an added personal regret that the serpent was punished by being forced to crawl on its belly, since I would have loved to see how it might have ambulated otherwise: perhaps bouncing on its tail as on a pogo stick.

untenable to see ourselves as somehow outside of—never mind superior to—the rest of “creation.” *Through a Glass Brightly* therefore outlines a less grandiose but more bracingly accurate view of ourselves, thanks to modern science.

It is the height of paradox. The more we learn about our own species and the world around us, the more we are humbled, forced to relinquish some of our most cherished illusions, especially our unique centrality. This demotion was given a dramatic push by Copernicus, Kepler, and Galileo, who upended the Ptolemaic view that the cosmos revolves around a central and immobile planet Earth. It is difficult for us in the twenty-first century to appreciate how troublesome, even painful, it was for our home—and by extension, ourselves as well—to be so irrefutably downgraded.<sup>b</sup> Emblematic of this, the sixteenth-century Danish astronomer Tycho Brahe (one of the finest scientists of his day and probably the greatest naked-eye astronomer of all time) proposed an alternative to the Copernican system. According to Brahe’s paradigm, the five known planets—Mercury, Venus, Mars, Jupiter, and Saturn—all circled the Sun, but that conglomeration in turn revolved around a central Earth. Many astronomers note, incidentally, that Brahe’s proposed system was in fact a good fit with the data available to him, and that his “blunder” wasn’t so much a result of prevailing religious belief as an understandable reluctance to discard the reigning Earth-centered system and replace it with the newer solar one unless the evidence was indisputable.

Such an adjustment was, however, ultimately necessary, and although immensely consequential, it was part of an even broader and deeper substitution, what the pioneering sociologist Max Weber called the “disenchantment of the world,” exemplified by Galileo’s more general discovery that the world lends itself to material explanations: objective as distinct from subjective, natural rather than supernatural. In *The Myth of the Machine*, the historian Lewis Mumford complained,

Galileo committed a crime far greater than what any dignitary of the Church accused him of; for his real crime was trading the totality of human experience for that minute portion which can be observed and interpreted in terms of mass and motion . . . . In dismissing human subjectivity Galileo had excommunicated history’s central subject, multi-dimensional man . . . . Under the new scientific dispensation . . . all living forms must be brought into harmony with the mechanical world picture by being melted down, so to say, molded anew to conform to a more mechanical model.<sup>1</sup>

<sup>b</sup> It has been argued, by the way, that not all contemporary theologians and philosophers felt that the center of the universe was such a good place to be. Thus, the center of the Earth was widely considered to be the abode of hell, and the center of the universe, not much better.

It is said that after being forced to recant his claim that the Earth moves around the sun, Galileo muttered to himself, “E pur si muove” (And yet it moves). The story might be apocryphal, but the underlying mechanical model, the cosmic machine of which everyone and everything is a part, is no myth. Nor is the resistance that it continues to evoke.

After the Copernican revolution and the one that Galileo initiated (which is still a work in progress) came the Darwinian revelation that we, along with the rest of the living world, aren’t the products of Special Creation, but rather the results of a natural, material process that physically connects us to all other organisms. Even now, opponents of evolution cling desperately to the illusion that human beings—and, in some cases, living things generally—are so special that only a benevolent Creator could have produced them. For these people, it remains a hard sell that the organic world, like the sun and its five planets, doesn’t revolve around us.

The third major leg of this troublesome triad was initiated by Freud, who (despite his occasional crackpot flights of fancy) came up with at least one solid and highly consequential discovery: the existence of the unconscious. Regardless of what one thinks of “penis envy,” the “Oedipus complex,” and so forth, there is general agreement that the human mind is like an iceberg, with much of its mass hiding below the conscious waterline.

So, not only have we been kicked out of our presumed astronomical centrality, immersed in a world of materiality and deprived of our widely assumed creaturely uniqueness, but we aren’t even masters in what seemed to be left to us, our pride and joy: our rational, conscious minds.

Of course, there are many people for whom the more we learn about the natural world, the more wonderful it is revealed to be, and thus, the more magnificent its Creator. It is likely, nonetheless, that insofar as human beings are perceived as “natural,” and thus explicable in terms of widely accepted scientific principles rather than uniquely fashioned by supernatural intervention, the more resistance will be evoked among those committed not just to human specialness but also to perceiving this specialness as evidence for divine power and intervention. It is hard enough to adjust your opinion—think of how much easier it is to change your clothes than to change your mind—harder yet to relinquish a cherished perspective. Especially one that has the blessing of religious belief. As Jonathan Swift noted centuries ago in his essay, *Seeking Wisdom*, “You cannot reason a person out of a position he did not reason himself into in the first place.”

The only constant, nevertheless, is change. The story is told of an ancient ruler who tasked his advisers to come up with a statement that would be true at all times and for all occasions. Their response: “This too shall pass.” But although the world’s factual details are constantly shifting (as the philosopher Heraclitus pointed out, you cannot

step in the same river twice, and, as Buddhists note, all things are impermanent), the basic rules and patterns underlying these changes in the physical and biological world are themselves constant. So far as we know, light traveled at the same speed during the age of dinosaurs, during the Peloponnesian War, and today. The Second Law of Thermodynamics is true and was true long before Carnot discovered this principle, just as special and general relativity was valid before being identified by Einstein.

Compared to the apparently unchanging nature of physical law, our insights are always “evolving,” along with living things themselves, although recognizing and understanding these insights often requires a major paradigm shift. Interestingly, although much has been learned (and more yet, hypothesized!) about how science proceeds to generate reliable knowledge, relatively little is known about how and why people—including scientists themselves—change their personal beliefs. On the one hand, we have Max Planck’s famous quip, “A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it.” And on the other, the more optimistic and probably widespread notion that, eventually, the truth will out.

To be clear, I am not claiming that clinging to factual error is necessarily the result of benighted religious prejudice or the simple psychology of denial. Sometimes, incorrect scientific ideas enjoy popularity because they are a good fit with current empirical data. Initially, nearly all competent astronomers resisted Copernicus’s model, at least in part because it didn’t accord any better with astronomic observations than did the regnant Ptolemaic one. However, at least some of that resistance was due, as well, to the painful emotional and theological reorientation necessitated by its acceptance.

“All truths are easy to understand once they are discovered,” wrote Galileo. “The point is to discover them.”<sup>22</sup> Much as I revere Galileo, I am not at all sure that in this regard he was correct. Sometimes, the problem isn’t simply to *discover* truths but to *accept* them, which is especially difficult when such acceptance requires overcoming the bias of anthropocentrism, whereby people put their own species at the center of things. Although my hope is that seeing *Homo sapiens* through the bright glass of science will contribute to humanity understanding and accepting itself, given the stubborn persistence of anthropocentric thinking, I cannot promise success. The writings of the “new atheists” offer a possible parallel: Dawkins, Harris, Dennett, and Hitchens do not appear to have converted people to atheism so much as they have helped initiate a discussion, such that even though atheism is not nearly (yet?) mainstream, it has become more respectable.

Thomas Kuhn famously suggested that each science operates within its own paradigm, which limits the ability of its practitioners to conceive other approaches—until a “paradigmatic revolution” supplants the prior intellectual system with a new one, which in turn, is similarly limiting. A related problem is that of “unconceived

alternatives,” whereby our ability to make sense of natural phenomena is restricted by our own failures of imagination. (After all, an evolutionary perspective suggests that the human mind has evolved to maximize the fitness of its possessor, not necessarily to provide accurate information about the world.) To this must be added a seemingly focused resistance to what I label anthropodimintion, whereby alternatives that demote humanity’s already wounded self-image are especially hard to conceive.

The present book is intended to help undercut this resistance, in part by emphasizing that our naturalness does not really diminish us, except with respect to the notion that human distinctiveness derives from being in some sense cut off from the rest of the natural world. It contends, by contrast, that pointing out humanity’s materiality—and thus, our profound linkage to everything else—only enlarges and thereby enhances our status.

In his *Ethics*, Spinoza wrote, “men commonly suppose that all natural things act, as men do, on account of an end [and] . . . that God has made all things for man, and man that he might worship God.” Spinoza felt that this belief was nonsense: “The wise man seeks to understand Nature, not gape at it like a fool.”<sup>3</sup> And definitely not to see Nature as serving human ends or to perceive ourselves as central to Nature, which itself must be subject to human concerns.

This puts certain popular practices in a different light. For example, the craze to take “selfies,” thereby inserting one’s image into social situations and natural scenes, may well be powered by the satisfaction of being literally incorporated into a circumstance for which one is otherwise peripheral—if present at all: “Look at me! Here I am!” Similarly with the use of the Internet as a self-reinforcing echo chamber, whereby people arrange to encounter ideas and perspectives that accord with their own, thus not only feeding their particular interests but also (more to the point and more unfortunately) reinforcing the illusion that their ideas and perspectives are central to public discourse such that alternative views hardly exist. And that, in any event, they don’t count for very much.

A perspective based on science is a corrective to this seductive myopia, whereby we are all tempted to see ourselves as bigger, more important, more central to the world than we really are. Admittedly, sometimes it helps to be in over our heads, insofar as this helps us understand just how tall we really are. Sometimes, accordingly, it is in our interest that as Browning suggested, our reach exceeds our grasp, since we expand ourselves and our capabilities by striving, by “demanding the impossible” instead of settling for whatever is readily available and achieved without effort. But although effort is good, delusions are not, and misconceptions of grandeur and of centrality are not only inaccurate but potentially dangerous. There is no better corrective to such delusions than the cold shower of scientific inquiry. Paradigms lost can thus be wisdom gained.

**IT IS EASY** to think of science as essentially organized common sense, based as it is on generating hypotheses, testing them, evaluating the results of those tests, and then, if the findings are consistent (especially if they are coherent with a prior, unified body of theory) and if the predictions aren't falsified over time, concluding that the results are scientifically meaningful, whereupon they are added to our body of knowledge. Science is a phenomenally powerful tool, the strongest and most effective yet devised. Contrary to widespread assumptions, however, science is at its most useful when its specific findings go counter to common sense. Indeed, science can usefully be conceived as a *corrective* to it. Otherwise, we wouldn't need science; we could simply "go with our gut."

Isaac Asimov (who was a highly regarded biochemist before he became a famous author) once noted science is "a way of trying to improve your knowledge of nature, it's a system for testing your thoughts against the universe and seeing whether they match."<sup>4</sup> Often they don't, and when that happens, it isn't the universe that is wrong.

Intuition can be a misleading guide, even when it comes to something as seemingly cut and dried as physics. For example, it is tempting to assume—as did notable thinkers since Aristotle—that a heavy object would fall more rapidly than a light one. This was widely taken as a commonsensical "fact" until Galileo demonstrated that it isn't true (although there is some doubt whether, as widely thought, he actually tested this by dropping two objects from the leaning tower of Pisa). Or take a ball on a string and swing it around in a circle. Now ask yourself: if you let it go while it is rotating, what path will it take? Many people—even college-educated science majors—assume that it would travel in a spiral. But it won't. It will continue in a straight-line tangent to the circular route that it had been following.

There are many other cases in which what seems obvious is wrong. The sun doesn't go around the Earth, as it appears to do. That same Earth isn't flat, as it seems to be. Apparently solid objects are actually composed of mostly empty space. Science is a pushback against the errors that are frequently incorporated into what is often taken for granted. It is closer to the Enlightenment than to Romanticism, basing its insights on skeptical inquiry, data, analysis, interpretation, and debate rather than gut feelings. It takes, after all, an outright denial of intuition to acknowledge that tiny organisms—much smaller than anything we can see with the unaided eye—can make us ill. Hence it is disturbingly easy for the antivaxer movement to gain adherents, even though being unvaccinated is immensely more dangerous than the alternative.

This route leads, of course, to our own species and the pervasive common sense perception that *Homo sapiens* is discontinuous from the rest of nature, and that even aside from the presumption that we have souls and "they" do not, human beings are more advanced than other animals—once again presumably because of our big brain and what it can do. The opposite of "advanced" is primitive, as in "a flatworm has a



brain which, compared to that of a person, is primitive.” In her book, *The Incredible Unlikelihood of Being: Evolution and the Making of Us*, Alice Roberts<sup>5</sup> points out, “All tetrapods around today have five digits or fewer at the end of their limbs. So it seems reasonable to assume that we’ve all descended from a five-fingered, or pentadactyl, ancestor.” Accordingly, at least with respect to our toes and fingers, we are primitive rather than advanced. On the other hoof, by contrast, a horse’s toe, at the end of each limb, consists of but a single digit, making it more advanced than ourselves, at least when it comes to its tip-toe middle digit—technically the *digitus impudicus*—whereby *Equus caballus* is more different from the ancestral vertebrate condition than we are. (This also means, Dr. Roberts notes, that horses are walking around giving us the finger.)

In most other respects, our demotion—more accurately, our inclusion in the material bestiary of the real world—courtesy of science, is not only long overdue but somewhat more serious. When Carl Sagan famously informed his television audience that we are all made of “star stuff,” the deeper implications may well have been lost on many of his fellow star-stuffed critters. Please meditate, for a moment, on the fact that there is literally nothing special about the atoms of which everyone is composed. Even in their statistical preponderance by mass, these elements reflect rather well the chemical composition of the universe as a whole: oxygen, carbon, hydrogen, nitrogen, calcium, and so forth. Of course, there *is* something special about the way these common components are arranged; that’s the work of natural selection, which, when presented with alternatives, multiplied and extended the frequency of those combinations that were comparatively successful in replicating themselves. All this, in turn, further highlights the degree to which we are cut from the same cloth.

Recall Socrates’s dictum, “The unexamined life is not worth living.” The issue, with respect to the present book, is not so much examining your own life, or human life generally, but rather, understanding both and doing so with humility, honesty, and an expanded sense of interconnectedness and potential. According to the King James Version of the Bible, in 1 Corinthians 13:12, Paul wrote, “For now we see through a glass, darkly,” an observation that—suitably modified—led to the title of the present book. Paul went on to write that after this restricted, darkened field of vision, we could look forward, upon meeting God, to seeing “face to face,” adding, “now I know in part; but then shall I know even as also I am known.” Fine for believers, but for the secularists among us, there is even better news: through the glass of science, we can all know and be known, and see brightly, not in heaven but here and now.

Yet there is some wisdom in Paul’s “darkly,” namely that we don’t necessarily see the world with perfect accuracy. Why not? Because we haven’t evolved to do so. The fact that we can penetrate some of the universe’s deeper secrets, unravel our own DNA, and so forth, is remarkable, but not literally miraculous. Just as the human nose didn’t

evolve to hold up eyeglasses, but does a good job at it, and binocular vision evolved to enable our arboreal primate ancestors to navigate their three-dimensional lives and has subsequently done a good job enabling us to throw objects accurately, drive cars, and pilot airplanes, our five senses along with our cognitive complexity and sophistication evolved for many possible reasons, including navigating an increasingly complex and sophisticated social life, engaging in elaborate communication skills, making and manipulating tools and other devices, predicting the future, and so forth.

Once it became part of our armamentarium, human intelligence and perception has underwritten all sorts of additional activities, such as exploring the universe as well as our own genome and composing symphonies and epic poems; the list is nearly endless, but the basic point is that we didn't evolve with an explicit adaptive capacity to do these things. They were repurposed from neuronal structures and capabilities that emerged for other reasons, not unlike pedestrian curb cuts that have been engineered to permit wheelchair access from street to sidewalk, but are now used at least as much by bicyclists and skateboarders. The biological reality is that our perceived separateness may well have evolved so as to promote the success of our constituent genes, but at the same time, there was little or no evolutionary payoff in recognizing not so much our limitations as our lack thereof.

John Milton wrote *Paradise Lost* to “justify God’s ways to man.” In the end, what justifies science to men and women is something more valuable and, yes, even more poetic than Milton’s masterpiece or Paul’s vision: the opportunity to consume the fruits of our own continually reevaluated, deeply rooted, admittedly imperfect, and yet profoundly nourishing Tree of Scientific Knowledge, whereby we increasingly understand ourselves as we really are. I hope that most people will find more pleasure than pain in using science to do so, and in the process, seeing themselves and their species more accurately and honestly—more brightly, in every sense of that word—than ever before.

Since this hope might well seem overly optimistic—even downright smug—this is a good time to introduce something of a counternarrative, a brief meditation on *Piss-Poor Paradigms Past*: examples of received wisdom that, in their time, went pretty much unquestioned, even among those constituting the scientific establishment. My purpose here is not to cast doubt or aspersions on the scientific enterprise. Quite the opposite. It is to remind the reader that science is an ongoing process, and that whereas the Tree of Scientific Knowledge is a many splendored thing, it also consists of many branches that have ultimately proven to be weak—in some cases, perilously so.

Ironically, some people lose faith in science because of the regular revisions it undergoes, the irony being that it is precisely because science is constantly being revised that we are getting closer and closer to what we can unblushingly call the truth. In short, “what makes science right is the enduring capacity to admit we are wrong.”<sup>6</sup>

And there is no doubt that wrong has happened; science, or what used to pass for science, has undergone much pruning, in the course of which the following limbs (once thought strong) are among the many that have been amputated: vitalism (the idea that living things possess some sort of unique life force or “*élan vital*”), spontaneous generation (rats and maggots emerge from garbage, etc.), confidence that alchemy would enable its practitioners to turn base metals into gold, and widespread and stubborn belief in weird substances such as luminiferous aether, phlogiston, and caloric.

In retrospect, these now discredited concepts, which seem downright foolish via 20-20 hindsight, were reasonable in their day. Take the aether, which was seen as necessary to understand the otherwise mysterious behavior of light. So clear-cut was its apparent legitimacy that James Clerk Maxwell—probably the greatest physicist of the nineteenth century, and whose equations for electromagnetism are still fundamental today—asserted that of all theoretical concepts in physics, the aether was the most securely confirmed. In agreement were two of Maxwell’s most notable contemporary physicists: Lord Kelvin and Heinrich Hertz. The latter’s research on the propagation of radio waves had given further credence to the consensus that aether was needed as a substance through which both light and radio waves were transmitted.

For centuries, scientists also assumed the dogma of an unchanging Earth and a solid-state universe—now dramatically replaced by continental drift and the Big Bang, respectively. Britain’s renowned astronomer-royal Fred Hoyle coined the phrase “Big Bang” as a sarcastic response to what he perceived as a ludicrous alternative to the then-regnant concept of an unchanging cosmos. Now the Big Bang is received wisdom, along with the finding that there are signs of prior water on Mars, but no artificial canals, the existence of which was claimed by Percival Lowell, another famous astronomer.

Some of the most dramatic scientific paradigm shifts have involved biomedicine. Consider, for example, the long-standing insistence that there are four humors—blood, yellow bile, black bile, and phlegm, corresponding, it was thought, to human temperaments: sanguine, choleric, melancholic, and (no surprise here) phlegmatic, respectively. And don’t forget bloodletting as a widely acknowledged and scientifically “proven” medical treatment, now known to have hastened George Washington’s death and long practiced through much of the Western world. (The term “leech,” historically applied to physicians, didn’t derive from their presumed avariciousness, but rather, from the use of blood-sucking leeches as an instrument for ostensibly therapeutic exsanguination.)

Thanks to Pasteur, Koch, Lister, and other pioneering microbiologists, we have come to understand the role of pathogens in causing disease, resulting in the scientific discovery that “germs are bad.” This particular paradigm—displacing belief in “bad air” and the like (“influenza” derives from the supposed “influence” of miasmas in causing disease)—was vigorously resisted by the medical establishment. Doctors who would

routinely go from conducting autopsies on disease-ridden corpses couldn't abide the idea that their unwashed hands were transmitting illness to their obstetric patients, to the extent that Ignaz Semmelweis, who demonstrated the role of hand-borne pathogens in causing "puerperal fever," was ignored, then vilified, even, it appears, literally driven mad.

More recently, however, just as people have finally adjusted to worrying about creatures so small that they can't be seen by the unaided eye, a new generation of microbiologists have demonstrated the stunning fact that most microbes (e.g., including but not limited to the gut microbiome) aren't merely benign but essential for health. Nerve cells, we were long told, didn't regenerate, especially not within the brain. Now we know that actually they do. Brains can even produce whole new neurons; you *can* teach old dogs new tricks.

Similarly, it was assumed until recently that once an embryonic cell differentiates into, say, a skin or liver cell, its fate is sealed. The advent of cloning technology has changed this, with the finding that cell nuclei can be induced to differentiate into other tissue types. Dolly the sheep was cloned from the nucleus of a fully differentiated mammary cell, proof that the paradigm of irreversible cell differentiation itself needed to be reversed, especially—we now know—in the case of embryonic stem cells.

Until recently, physicians were scientifically certain that at least a week of bed rest was necessary after even a normal, uncomplicated vaginal childbirth, not to mention invasive surgery. Now surgical patients are typically encouraged to walk as soon as possible. For decades, protuberant but basically benign tonsils were unceremoniously yanked whenever a child had a sore throat. Not any more. Psychiatry offers its own pervasive, problematic panoply of paradigms past (and good riddance to them!). Until 1974, homosexuality for example was considered a form of mental illness, schizophrenia was thought to be caused by the verbal and emotional malfeasance of "schizophrenogenic mothers," and prefrontal lobotomies were the scientifically approved treatment of choice for schizophrenia, bipolar disease, psychotic depression, and sometimes, merely a way of calming an ornery and intransigent patient.

The catalog is extensive. Despite the claim that we have reached the "end of science," the reality is otherwise. For decades, the best scientific advice asserted, for example, that gastric ulcers were produced by stress, especially the hyperresponsiveness of people with "Type A" personalities. Then, in the 1980s, the Australian scientists Barry Marshall and Robin Warren demonstrated that most gastric ulcers are produced by a particular bacterium, *Helicobacter pylori*. In recognition of their paradigm-busting discovery, which had been vigorously resisted by the most scientifically esteemed minds in gastroenterology, Marshall and Warren received a Nobel Prize in 2005. There isn't time and space in the present book to explore the on again-off again controversies

over the health consequence of dietary cholesterol, red wine, caffeine, and so forth. A cartoon in *The New Yorker* showed a large, glowering, shapeless something-or-other poised outside a bakery, with the caption reading “The Gluten’s back. And it’s pissed.”

**THROUGH A GLASS BRIGHTLY** is divided into two parts:

1. Major paradigm shifts that involve diminishment of humanity’s self-image, and which have therefore been resisted with particular vigor, for example, heliocentric astronomy, the notion that human beings have been especially “well designed,” and so forth.
2. Reassessments of certain previously held notions that deal with specific aspects of “human nature,” many of them still alive in the public mind; for example, altruism cannot be explained by evolution and must therefore be a gift from god, and people are naturally monogamous. Here, my intent is less to argue against human centrality per se than to take issue with an array of preexisting beliefs that have themselves been privileged at least partly because they place human beings in a flattering but misleading light.

Accordingly, whereas Part I looks at (and seeks to debunk) the underlying concept of human centrality, Part II examines “human nature” in greater detail, showing that here, too, we find ourselves less special and more “natural” than an anthropocentric perspective on the human condition would like. In *Anti-Semite and Jew*, Jean-Paul Sartre wrote that the underlying basis of existential freedom can be found in what he calls “authenticity,” the courage and capacity to have “a true and lucid consciousness of the situation, in assuming the responsibilities and risks it involves, in accepting it in pride or humiliation, sometimes in horror and hate.”<sup>7</sup>

Lest there be any misunderstanding, I am not a species-hating human being, although I maintain that we—along with the rest of the planet and its inhabitants—would all be better off if our species-wide narcissism were taken down a peg or two, if we were to perceive ourselves with less *Homo*-centric delusions of grandeur. Science is supposed to be divorced from pride, humiliation, horror, and hate, and to a large extent, it is. However, as the biological anthropologist Matt Cartmill pointed out in a brilliant essay more than 25 years ago,<sup>8</sup> when it comes to scientific investigations into humanness, there has been a persistent tendency to move the goal posts whenever other species turn out to have traits that had previously been reserved for *Homo sapiens* alone. As soon as our biological uniqueness is challenged, there has been a scramble to redefine the characteristic in question so as to retain precisely that specialness.

Take brain size. Intelligence is obviously one of our most notable characteristics, which led to the assumption that the human brain must be uniquely, extraordinarily,

exceptionally, and altogether wonderfully large. But as Cartmill pointed out, the weight of the *Homo sapiens* brain (1–2 kg) bumped up against the awkward fact that the brains of elephants are larger (5–6 kg), and those of whales (up to 7 kg) are larger yet. This unwanted and uncomfortable reality brought forth a focus on *relative* brain size—comparing species by looking at brain weight in proportion to body weight. Gratifyingly, it happens that this number is substantially higher for *Homo sapiens* (1.6%–3.0%) than for elephants (0.09%) or whales (0.01%–1.16%). So far, so good.

Cartmill noted, however, that even in the realm of relative brain size, we are equaled or exceeded by that of many small mammals, including squirrel monkeys (2.8%–4.0%), red squirrels (2.0%–2.5%), chipmunks (3.0%–3.7%), and jumping mice (3.4%–3.6%). And so, “allogometric analysis” was then “invoked to rescue the axiom of human cerebral preeminence. The first step in such an analysis is to assume that the interspecific regression of the logarithm of brain weight on that of body weight ought to be a straight line.” Without getting into the details of allometric analysis, suffice it to say that even with this mathematical adjustment, porpoises ended up being “embarrassingly” close to human beings and so another way out was needed. What about assuming that brain size should be proportional to an organism’s total metabolic energy expenditure, that is, looking at the amount of energy invested in each creature’s brain in proportion to its total energy budget? Sure enough, if we obtain a measure of total metabolic expenditure, by multiplying body weight times baseline metabolic rate, it turns out that porpoises invest proportionately less energy in brain maintenance than do human beings. Even in this case, however, there is a problem, since as Cartmill observed, it is “a maneuver that a lizard might with equal justice use to prove that mammals don’t really have bigger brains than reptiles, but only higher metabolic rates.”

The above brain brouhaha doesn’t even touch the case of learning capacities among insects, whose brains are small indeed: fruit flies average only about 250,000 neurons per brain, and yet they are capable of learning to avoid certain stimuli and to seek out others, to orient themselves via a mental map of their surroundings, and so forth. Moreover, bumblebees—which have approximately 1 million neurons in their brains (a gratifyingly small number compared to mammals)—have recently been shown capable of learning to do something unlike any behavior they are likely to encounter in nature, namely to roll a little ball into the center of a platform in order to receive a small dose of sugar water. Not only that, but individual bumblebees also learn this relatively complex and heretofore unfamiliar behavior more rapidly if given the opportunity to watch other bees learning the task.<sup>9</sup> “Observational learning” of this sort had previously been considered a sign of higher mental powers, especially found in, well, us.

Writing about shared “intellectual faculties,” Darwin conceded in his 1871 book, *The Descent of Man, and Selection in Relation to Sex*, “Undoubtedly, it would have been very interesting to have traced the development of each separate faculty from the state