recommend buying a used car from either of them, still less would I take their advice on matters of health or medicine.

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Kicking the Sacred Cow: Questioning the Unquestionable and Thinking the Impermissible by James **P.** Hogan. Baen Publishing Enterprises, 2004. 374 pp. $24 (hardcover). ISBN 0-7434-8828-8, http://www.baen.com

Every reader of the *Journal of Scientific Exploration* will surely feel attracted to a book whose dedication is "To Halton Arp, Peter Duesberg—and all other scientists of integrity who followed where the evidence pointed, and stood by their convictions".

Many or most members of the Society for Scientific Exploration will feel kinship with Hogan's account of his growing realization that science, whose accomplishments and ideals had so attracted him, was becoming something quite different, akin to a dogmatic and bureaucratic religion. That growing realization shows that Hogan himself was following where the evidence pointed. Of course, most of us imagine that we do that; I certainly do. How can it then happen that I agree with Hogan on all significant points about what science is, has been, and should be—and yet differ from him sharply on several of the specific cases that he looks at?

This conundrum recalls a similar one that struck me soon after the Society for Scientific Exploration was founded. I met in the Society many competent, intelligent people, most of whom nevertheless seemed to take seriously

something that I had thought to be easily dismissible. I realized that my colleagues might be similarly puzzled: how was it possible that Henry Bauer could think it likely that a family of Jurassic reptiles is still enjoying life in a Scottish loch?

Reviewing this book affords an opportunity to explore these conundrums.

Hogan seeks to deal not with "cranks" but with "instances of present-day orthodoxies tenaciously defending beliefs in the face of what would appear to be verified fact and plain logic" (pp. 5–6). Kicking the Sacred *Cow* focuses on six large areas of science in which a paradigm is so entrenched that dissenting voices are ignored or suppressed: evolution; cosmology; relativity; Velikovskian catastrophism; environmentalism; HIV/AIDS. There is a good index, endnotes for each section (numbered in an unusually convenient way, sequentially throughout the book), and a bibliography that is also arranged conveniently by section[1]. Hogan notes in the Afterword that he has changed his views on some of the subjects dealt with in this book.

The Introduction describes Hogan's early contacts with science and its medical and engineering applications, which made science seem the royal road to knowledge, the best guide for humans to follow. Hogan's writing focused on "a theme of hard science-fiction with an upbeat note [that] came naturally", "reinventing the genre of the fifties and sixties" (p. 3). Disillusion began with the controversy over nuclear energy, where ideology trumped technical truth; and it continued with the public arguments over the ozone layer, carcinogens, and DDT (pp. 4–5). Hogan observed that scientists might scoff over unwarranted, extremist public claims in their own specialty while swallowing similarly unwarranted claims outside that specialty. This point has enormous significance in public controversies, yet is not widely enough appreciated. For example, when a group of distinguished scientists including Nobel Laureates issued a proclamation against astrology (Bok & Jerome, 1976), only a few people (e.g., Westrum, 1976) understood that these people might not command the specifically relevant knowledge on which to base their proclamation. As Harvey Bialy (2004: 144–145) also noted recently, most scientists get their information on matters outside their very narrow field from such journals as Nature and Science, which reflect the mainstream consensus and assiduously exclude dissenting views.

"Browsing in a library one day", Hogan came upon a creationist book disputing the conventional explanation of the fossil record. Talking to biologists about it, he found that some who privately agreed with some of this would not say so publicly, whereas those who spoke publicly did so with fury at the mere mention of such heresy. Hogan's education in heretical science continued through meeting personally Peter Duesberg, who disputes that HIV causes AIDS; Petr Beckrnann, the electrical engineering professor whose theory yields the same equations as Einstein's relativity but with quite different physical interpretation and implications; and Halton Arp, who has collected evidence that some redshifts are not speed- or distance-related. In this way, Hogan came to

realize that science is as much subject to human vagaries as is any other human activity. Science is conservative; burdened with personal and institutional self-interests, as was the medieval Church; infiltrated and corrupted by massive government and commercial funding. Hogan used to suggest that "science was the only area of human activity in which it actually matters whether or not what one believes is actually true. Nowadays, I'm not so sure".

The book's Afterword continues these themes. Scientific controversies focus on details while ignoring the larger issues. Some of the greatest breakthroughs have been made by outsiders not constrained by the prevailing mainstream paradigm. Government funding brings bureaucracy, which is inhospitable to creativity. And science is not separate from the society in which it is done: "Although lip service is paid to the virtues of truth and integrity, the social dynamic that rules is a reflection of the value system of society at large, where the rewards are in material compensation, power, and prestige" (p. 336).

I liked to needle my colleagues in the social sciences by insisting that academic psychology and sociology understand human nature less well than have the great novelists and playwrights of the last couple of millennia. It occurs to me that a similar comment might be made about the academic students of science—philosophers and sociologists of science and other participants in the field of "science studies"—in comparison to writers of fiction who deal in some manner with science. Many years ago, Marcello Truzzi had told me to read Hogan's science-fiction book, Code of the *Lifemaker*, because it contained the best short description he had come across of what constitutes good scientific method; I did read it, and agreed. In Kicking the Sacred Cow, Hogan paints the "big picture" about contemporary science and its cultural role accurately—as did non-academic Bryan Appleyard (1992), in both cases better than in any academic work of science studies of which I am aware[2]. Science-fiction writer Michael Crichton is similarly insightful, as noted in this Journal by David Deming (2005). One might add to this honor roll Arthur C. Clarke, C. P. Snow, and a few works by people who wrote only one or two novels on scientific themes—James Hilton in Nothing So Strange (1947) and Nigel Balchin in The Small Back Room (1943 and many later editions) and A Sort of Traitors (1949; in the United States, Who Is My Neighbor?). It may be that these works portray science and scientists so realistically because these writers are centrally concerned with the human implications of science, if not in the actual real world then in a conceivable world; by contrast, writings in academic "science studies" seem unconcerned to relate their insights to anything that might be actually meaningful to the general public in any sort of world'.

In my view, then, Hogan sees the big picture clearly and accurately. As to specifics, I agree that it is worth attending to the views of those who question the intellectual monopolies exercised by Big-Bang cosmology, Einstein's relativity theory, global warming, and the view that HIV causes AIDS. Though I had previously accepted—without any detailed study—the mainstream view as to ozone depletion and the dangers of DDT, I find substantive and thought-

provoking the documentation Hogan offers against those beliefs. But two of the heresies that Hogan treats as meriting attention[4] I continue to dismiss as—dare I use the term?—pseudoscience: creationism and its modern congener, intelligent design (ID); and Velikovskian catastrophism.

Evolution

The factual claims in this section of the book are drawn predominantly from Richard Dawkins, the leading missionary of reductionism, materialism, and "Darwinism"; from several proponents of creationism or ID—Michael Behe, William Dembski, Duane Gish, Jonathan Wells; and from two lawyers, Phillip Johnson and Norman Macbeth, who repudiate the creationist label and call themselves just anti-Darwinist.

Having read something by all these people, as well as critiques of their work, I simply don't trust what any of them say. The lawyers have much recourse to rhetorical tactics and Jesuitical reasoning[5]. The creationists restrict their focus to matters that evolutionary theory supposedly cannot explain, and they do not hesitate to misquote and misdirect. As to Dawkins, with him as a proponent, evolution needs no enemies to portray its views as unpalatable; Dawkins is a God-send for the anti-Darwinists, the easiest and most appealing of targets.

Missing from this section of the book are the voices of those who truly seek to follow the actual evidence wherever it may lead. This absence may well be owing in part to the grievous lack of good popular-science writing on these matters. Though there are popular works expounding the evolutionary viewpoint and its implications, there are few works accessible to and interesting for the general public that expose the fallacies and weaknesses of the ID movement[6]. ID has been superbly successful in public relations and political activism; the public seems little influenced by the fact that every direct substantive confrontation on neutral ground, for example, in the courts, has been a victory for evolutionary science.

The significant points that Hogan repeats from the ID camp amount to no more than that much has not yet been explained. ID attempts to parlay that into unexplainable, but "The slide from 'not yet explained' to 'unexplainable' is one of the trademarks of spurious science" (Bauer, 2001a: 127). Evolutionary biology does not claim a final explanation for everything (as, incidentally, ID and creationism do); it simply states that descent with variation happened, as shown by the evidence of family relations and their chronology. It is a red herring favored by the creationists to ask, "But how could it have happened?" That is a theoretical argument, not an empirical one. It is pursued through the invention of such concepts as "irreducible complexity" and "specified complexity" and "information", abstractions arrived at non-inductively and lacking concrete definition. They, and other ID assertions, also depend on erroneous calculations of probability extrapolated beyond reason[7]. The claim that something in the real world is impossible—in other words, probability = 0—is not an empirical claim; and no calculation based on our fallible instincts and

incomplete knowledge, even if they lead to smaller and smaller probabilities, can ever suffice to convert a small probability into a zero probability. As Hogan himself rightly recognizes as a general principle, science is an inductive activity, not a deductive one. Neo-Darwinism is an empirical research program; ID is not, no matter that its proponents assert that it is; by their fruits, no one would know them as empiricists.

The actual state of evolutionary facts and theory should be judged by the writings of such biologists as Ernst Mayr (1991, 2002) or such philosophers of biology as Marjorie Grene (Grene & Depew, 2004), David Hull (1988, 2000), and Richard Burian (Brandon & Burian, 1984; Burian et al., 2000). All the evidence so far gathered points to family resemblances among all living creatures, congruent evidence from such independent lines of research as the fossil record and the molecular biology of genes and proteins. That the family resemblances bespeak ancestry is indicated by the chronology of the fossil record, which has turned up no anomalies that falsify the evolutionary interpretation. No multi-cellular creatures pre-dated the unicellular ones, for example. Mammals do not show up earlier than reptiles. Birds do not pre-date the dinosaurs.

It is an entirely false assertion by proponents of ID that "'point mutations' are the sole source of innovation that the neo-Darwinian theory permits" (p. 38). Evolutionary biology recognizes the importance of genetic "neutral drift". Symbiosis has exerted a profound influence[8]: the mitochondria of animal cells and the chloroplasts of plant cells are descendants of bacteria incorporated into other bacteria. In speciation and surely in macroevolution, changes in the numbers and arrangements of chromosomes—fully recognized by geneticists and by evolutionary biologists—play a large role, and these are also unlikely to result from point mutations.

Evolutionary theory does not claim finality, nor do sensible evolutionary biologists do so; no scientific theory can properly claim finality. The initial origin of life remains to be understood. Much about the mechanisms of evolution remains to be understood. Much about development remains to be understood. The early "Central Dogma" of one gene, one protein has not stood the test of time. Contemporary theories about evolution, and about other aspects of biology, will continue to change as the years go by. Who knows? Perhaps we will even discover that one cannot speak of "mindless, inanimate matter" (p. 56); after all, the placebo effect has already demonstrated that "mind" is more powerful than "matter" in some ways in some situations, and perhaps this is just a natural property of "matter" that never is "mindless". Perhaps we will find that evolution can be directed or Lamarckian after all, and even that such a mechanism can arise through natural selection: since reverse transcriptase is present in all cells, perhaps at some time some fortuitous occurrence will generate a mechanism that uses this toward an end that an individual creature has found useful.

It seems appropriate to remain humble in our assessment of what is and what is not possible in this world. "Information" is no more a fundamental criterion

or characteristic than "the laws of Nature". Insisting that there exists irreducible complexity or that "information" could not have arisen by itself says no more than that there are things in this world that are yet undreamed-of in our science. Einstein has been rebuked for telling God that He must not play dice with the world. The ID claim that the natural world is incapable of doing certain things is no less hubristic and unfounded, for precisely the same reason.

Cosmology

It was a great relief to leave the section on evolution and be able to nod approvingly as Hogan relies on competent researchers who have demonstrated weaknesses in certain mainstream ideas in cosmology: Alfvén, Arp, Dicke, Gamow, Hoyle, Lerner, and Marmet are all fully expert as to cosmology, even though some of their views are unorthodox. They do not clamor from outside the relevant disciplines as do Dembski and his ilk.

Hogan gives a nice review of how knowledge and theories about the origins of stars and galaxies and the universe have developed. He points out that the cosmic background radiation, hailed as proving the Big Bang, does nothing of the sort. He describes the grasping for more and more far-out, *ad hoc* notions to preserve the current mainstream picture: dark matter and inflation, say.

The oddity is mentioned that Alfvén's electromagnetic, plasma universe is capable of explaining everything that Big-Bang cosmology does, and more than the Big-Bang can, yet is ignored, though Alfvén is a Nobel Laureate. The evidence accumulated by Arp is explained clearly and concisely to show that some redshifts are inherent and not speed- or distance-dependent. The quantization of redshifts is also mentioned.

Relativity

Hogan notes that this topic "attracts cranks in swarms". He makes the important point that it is not a matter of "right" or "wrong", but whether the physical interpretation attached to Einstein's equations should be preferred over the physical interpretation implied by other sets of equations that are equally capable of making correct calculations of observed phenomena. Here again is an obvious, well-known fact that is all too often ignored in specific cases: that any given equation produces correct predictions does not prove that equation "true", still less does it give support to any physical interpretation attached to that equation. The diffraction and the energetic interactions of electrons and the like can be calculated precisely, using in the one case wave equations and in the other particle equations; but electrons are not waves, and they are not particles, and they may not even be "wavicles", since that would imply an existence quite separated from their surroundings, whereas certain strange "quantum" phenomena imply that such entities are always in some sort of touch or communication with one another.

Hogan cites appropriate anecdotes about mainstream fury at any questioning

of relativity. The technical issues are expounded clearly for readers with no previous background, and appropriate references are given for further reading.

Velikovskian Catastrophism

Hogan's title for this section is, "Catastrophe of Ethics: The case for taking Velikovsky seriously".

Immanuel Velikovsky was a psychiatrist who interpreted Biblical and other ancient texts as indicating that Venus had erupted as a comet from Jupiter and come close to Earth on a number of occasions, giving rise to catastrophic effects like the falling of manna from the heavens and the parting of the Red Sea. On later occasions, Mars—displaced by Venus—approached close to Earth with similarly startling consequences. Eventually the comet settled into its present planetary orbit.

Prominent scientists reacted with fury against these conjectures. Velikovsky's publishers were boycotted and people who gave him support lost their jobs. Some scientists publicly berated his ideas while boasting that they had not read his book. That was in the early 1950s. In the early 1960s, Velikovsky claimed vindication because certain discoveries—radio emissions from Jupiter, the high temperature of Venus, and others—seemed consonant with his propositions. Velikovsky became a guru for student activists, and social scientists made a fuss about the unscientific and unethical manner in which his book had been received a decade earlier. The early 1970s brought a fresh outburst of Velikovskian enthusiasm with the publication of periodicals explicitly devoted to his work. Some descendants of those organizations and publications are still extant.

I agree unreservedly that there was a "catastrophe of ethics": the scientific community let some of its leading lights get away with behaving inexcusably. An academic community that had suffered McCarthyite persecution practiced similar tactics against Velikovsky. However, this does not constitute a case for taking Velikovsky's substantive claims seriously (Bauer, 1984).

Reading Hogan's account was very much *déjà* vu for me. The Velikovsky Affair and the Loch Ness Monster had been the first examples of scientific heresies that I studied seriously. Like Hogan, on the Velikovsky Affair I relied at first on the only detailed accounts in the literature, which had been written by supporters of Velikovsky or by social scientists who were explicitly concerned with how he had been treated, irrespective of whether his ideas made any sense. Like Hogan, I found offensive the purported critiques of Velikovsky's ideas published by scientists—offensive in their sloppy incompetence coupled with dogmatic arrogance.

But as I dug into every available document, I came upon an early monograph self-published by Velikovsky, Cosmos Without Gravitation, that revealed his abysmal ignorance of the chemistry and physics that he nevertheless did not hesitate to write about. It also demonstrated that he had arrived at his whole cosmic scenario in a flash of insight, not following the decade or more of

inductive reasoning he and his supporters alleged. I refer interested readers to my analysis of the affair, *Beyond Velikovsky* (198411999). It deals with the chronology of the controversy, the lack of technical support for Velikovsky's claims, and non-technical clues indicating why he need not have been taken seriously. The book also discusses social and psychological factors that explain why Velikovsky has been taken seriously by some people, factors that include "Blundering Critics" and effective polemic strategies and tactics by Velikovsky and his supporters. I concluded by contrasting how science actually is done with the popular misconceptions about it, and suggested lessons for similar cases: public controversies in which technical issues play a central role.

I suggest that the chief reason why Hogan has not (yet?) reached the same conclusion as I about Velikovsky is that so far he seems to have relied—as I did initially—on the writings of Velikovskians. Perhaps this is why so many pages are devoted to inadequacies of Carl Sagan's critique of Velikovsky's notions, following the argument in *Carl Sagan and lmmanuel Velikovsky*, by Charles Ginenthal, an unreconstructed Velikovskian[9]. Hogan does not address the points made in my book as to why science had no reason to attend to Velikovsky, nor the writings of C. Leroy Ellenberger (1986, 1995, 1997), which show, for instance, that data from Greenland ice-cores exclude from possibility the global happenings postulated by Velikovsky. Much Velikovskian argument has been to the effect that the sort of planetary excursions imagined by Velikovsky are not impossible; maybe—but Ellenberger demonstrates that they simply did not happen.

Environmentalist Fantasies

Once again it was a relief to leave the section just described for that on environmentalism, where I agreed with Hogan on issues I was familiar with and learned from him about matters on which I had hitherto not questioned the conventional wisdom. Hogan points out that environmental issues are at root political and social; that is to say, environmentalists insist that political and social actions are needed because of some claimed phenomenon, whereas the scientific data are at best ambiguous.

Global Warming

The greenhouse effect stems not only from carbon dioxide, but also from water vapor, whose contribution to the effect is variously estimated to be between 95 and 99% (for this, see also Kauffman, 2004). Computer models of the global climate are primitive, ignoring of necessity such known phenomena as the oceanic transport of heat from the tropics to the polar regions. Extreme events like a huge iceberg breaking from Antarctica in 1998 are widely cited as demonstrating the global warming that is under way, yet larger icebergs broke off in 1854 and 1927.

Though carbon-dioxide levels and estimated average temperature show a sort

of correlation, it is approximate only; from 1940 to the mid-1970s, carbon dioxide increased while global temperatures fell, causing *Science* and *Newsweek* to warn of an impending Ice Age. Most tellingly, measurements on ice cores and various other independent techniques reveal that the correlation between carbon dioxide and temperature indicates that the gas levels rose *following* increases in temperature, with a lag time of about fifty years.

An interesting tidbit is Herschel's suggestion that more sunspots correlate with warmer weather, and that the price of wheat would be a good surrogate marker for warmer weather—which turned out to be correct. It is also worth being reminded that, *as is well known,* only a few thousand years ago Siberia and the Sahara were fertile, densely forested, and profusely populated with animal life, *because global temperatures were higher than nowadays.*

The Leipzig Declaration signed by hundreds of meteorologists and scientists in related fields stated, "there does not exist today a general scientific consensus about the importance of greenhouse warming", but the media did not make a big story of that. A report by the Intergovernmental Panel on Climate Change was altered after its approval by scientists, eliminating phrases to the same effect as in the Leipzig Declaration. A survey carried out by a German meteorological institute found that 67% of Canadian, 87% of German, and 97% of American scientists do not believe human activity is contributing to global warming.

Ozone Layer

Hogan gives a nice summary of the scientific issues involved in the matter of the ozone layer, emphasizing that ozone is continually created by the action of ultraviolet light on oxygen as radiation from the sun strikes the outer atmosphere. The amount of ozone present at a given time at a given location and height is the end result of a number of mechanical (transport), chemical, and photochemical processes. Natural phenomena such as the release of chlorine from volcanoes contribute far more than could the leaking at ground level of any conceivable amounts of the compounds (chlorofluorocarbons, CFCs) indicted for destroying the ozone layer. Large observed fluctuations in the ozone layer were long ignored. NASA called for rapid elimination of CFCs just when its budget was up for renewal. (That reminded me of Daniel Greenberg's [2001] recounting of the baseless claim by the National Science Foundation that a shortage of PhD scientists was in the offing, which was followed by years of overproduction of science PhDs.)

A graph is reproduced from an article in the *Journal of Geophysical Research* that shows the annual fluctuations in the ozone layer; the authors identified a U-shaped trend, whereas official bodies interpret it as a steady downward trend.

DDT

Hogan points out that the controversy over DDT was the first instance of public agitation over a supposedly pending environmental catastrophe. One of

the elements, present in all later cases, was the abuse of scientific information through selective emphasis. The media seized on dramatic claims of impending disaster and ignored the actual scientific data and the range of scientific interpretations. Scientists who spoke up in contradiction to the startling claims were ignored. Hogan calls this "a process of education-by-headlines"; it produces what I've called knowledge monopolies (Bauer, 2004).

A number of studies are cited that found DDT harmless to humans in any conceivable dose and that contradict the common beliefs that DDT gets concentrated through the food chain, that it persists in the environment for a long time without being chemically broken down, and that it caused a decline in bird populations. The main source Hogan cites is Claus and Bolander (1977).

At hearings held by the Environmental Protection Agency (EPA), the presiding judge summarized the scientific consensus as being that DDT has no deleterious environmental or health effects. The World Health Organization issued a statement emphasizing the benefits that DDT had brought through anti-malaria activities. But the EPA overruled the judge, and the production and sale of DDT were banned.

Radiation

Hogan presents evidence that low doses of radiation are beneficial, not harmful. Readers of this *Journal* will already be familiar with that fact through Joel Kauffman's (2003) article on radiation hormesis. Nevertheless, the conventional wisdom exercises a knowledge monopoly to the effect that we should beware of *all* radiation, including dental X-rays and the like.

Asbestos

The ban on asbestos ignored the difference between two forms of the substance, the commonly used and harmless one and the dangerous one that is rarely encountered. One result of the ban may have been the collapse of the World Trade Center. The upper floors were insulated with a "non-asbestos" "jury-rigged" substitute, whereas the lower floors had been insulated—before the asbestos ban became effective—with a mixture of asbestos and rock wool. Herbert Levine, who had invented that mixture, said about the substitute, "If a fire breaks out above the sixty-fourth floor, that building will fall down" (p. 295). A sealing putty used in space shuttles had contained asbestos, so it was replaced by a different material; failure of an O-ring made of that substitute was found to have been the cause of the Challenger disaster (p. 295).

HIV/AIDS

The literature cited by Hogan in this section is a representative sampling of dissidents (many of them biologists) from the conventional view that HIV causes AIDS. A potent new virus came as a boon to the community of virologists whose

attempts to find viruses that cause cancer had long been stymied. That a single virus could cause the many different illnesses associated with AIDS was explained by conceiving the virus as destroying the immune system. Over the years there were several changes in the criteria used to diagnose "AIDS"; in the early 1990s, they were made to include a positive test for HIV. Since then, HIV causes AIDS ***by definition:*** tuberculosis without a positive HIV test is called TB, but tuberculosis with a positive HIV test is called AIDS.

Soon it became evident that illness followed only years after infection with HIV, and convoluted explanations were constructed in the attempt to explain this oddity. Peter Duesberg pointed out that HIV does not satisfy the criteria traditionally invoked as proof of an infective agent: HIV has ***not*** been isolated from every AIDS victim; HIV has never been isolated in pure form and grown in a pure culture; HIV "isolates" have never been shown to produce AIDS in chimpanzees, the animals most closely similar to humans, even though chimps have been successfully infected with HIV. Said to destroy the immune system, HIV has been found in only about one in every thousand of the T-cells that it supposedly lulls. As to transmission, HIV behaves like the typical, harmless retrovirus of which huge numbers are carried in the human genome: It is transmitted chiefly from mother to child.

The announcement of HIV as the cause of AIDS had been made at a press conference before any publication in a scientific journal, and thus before there had been any peer review. There is still no article or set of articles that gives a conclusive proof: The mainstream view is supported solely by the assertion that ***most*** AIDS victims test positive to HIV ***antibodies.*** But those HIV tests are highly unreliable, producing large numbers of false positives.

AIDS in Africa has nothing to do with AIDS in the United States. In Africa it affects men and women in equal numbers, and it is diagnosed via the Bangui definition: persistent fever, diarrhoea, and weight loss—symptoms that are equally symptoms of malnutrition, malaria, and other diseases endemic throughout Africa. No HIV test is required in Africa to diagnose AIDS or what has become its synonym, "HIV infection"!

That AIDS was initially thought to be invariably and rapidly fatal led to the adoption of "treatment" with a highly toxic "anti-retroviral" drug, AZT. AZT and the later treatments were all greatly acclaimed when first introduced; but all are associated with highly dangerous side-effects, and no treatment has been shown to lengthen the lifespan of AIDS victims. All the drugs do, however, lower the quality of life for people who have no symptoms of illness but test positive for HIV.

The prime reason why Hogan and I differ on some of these cases lies, it seems to me, in the sources on which we have relied. As to cosmology, relativity, the environmental issues, and HIV/AIDS, the dissidents are card-carrying members of the relevant scientific communities. What they write is well grounded in the disciplines in which they dispute the mainstream view. By contrast, the Velikovskians and the proponents of ID have not made cases that are well

grounded in the disciplines in which they dispute the mainstream view. Of course, that is not an infallible criterion. As I have argued at considerable length elsewhere (Bauer, 2001a), the only way to reach a satisfactory decision on controversial matters of this sort is to look into them for oneself, with all the skepticism and scrupulous chasing-down of sources that one can muster. In some cases (HIVIAIDS, say, or global warming), the literature is so vast that no one can read it all; in others (Velikovsky, say, or the Loch Ness Monster), it is so unorganized that it is difficult even to locate most of it (Bauer, 1986: 49 ff.). In all cases one has to read critically quite a lot of the literature before acquiring a basis for judging how much or little credence to give any particular item or author. No shortcut is available. There is no authority whom you can safely trust on every such matter. You may find someone who is very knowledgeable and reliable about some things (say, Bauer, about Nessie and HIVIAIDS) who may express himself with equal certitude on other matters while being seriously misinformed about them (say, Bauer, about UFOs[10] or about homosexuality[11]). Caveat lector: If you accept anyone's "expert" opinion without further ado, you are liable to acquire beliefs that may be indefensible.

If you want a good answer on matters like those dealt with in Hogan's book—which are only samples of the many controversial questions in science and medicine on which the media offer misleadingly simple answers—the only way to proceed is to look into them assiduously for yourself. On that, I venture to think that Hogan and I are in perfect agreement.

Perhaps the chief lesson to be drawn is that we should resist being 100% certain[12] about any of these things—so certain that we demand that others share our belief. **A** rather easy first step is to recognize that everyone can make mistakes. A more difficult second step is to acknowledge that one might oneself make mistakes. Where that is on a matter where we have already realized the mistake, it is possible (if not pleasant) to overcome embarrassment and acknowledge having made a mistake, as I just did about UFOs and homosexuality. The ***really*** difficult step is to be constantly aware that one can be wrong even on those issues where one is most sure of being right, as I am over Nessie and HIVIAIDS. The only helpful tactic that I've found here is to make it an absolute rule: "No 100% certainty about ***anything".*** So, every now and again, I perform some thought-experiments, creating scenarios in which I might be wrong about what I just know to be true. I try to conceive ways in which the Dinsdale film (Bauer, 2002) might not show a Nessie, for example. I remind myself often that it is easy to slip into a presumption that unorthodoxies are likely to be substantive just because a few have been, that official science is likely to be wrong just because it has sometimes been. Far from it: The mainstream is usually right over most matters of science. My worry about the rise of knowledge monopolies and research cartels (Bauer, 2004) is not about the quality of the science that scientists do, it is over the control that bureaucracies and the media have come to exercise over public knowledge about science. Science needs to be taken back from the bureaucracies.

I hope these arguments about and digressions from Hogan's book underscore that everyone can surely learn something from this book, from thinking about the general issues and the specific questions raised in it and from arguing with Hogan and with oneself about the pros and cons of these things. These issues should be the focus of continuing discussion in the scientific community and among those who deal with applications and implications of science; they should be made familiar through formal education, and the media should be thoroughly informed about them. That is far from the case; and that fact amounts to a resounding failure in our culture on the part of both the media and of education.

Notes

[1] In my review copy of the book, all bibliographic entries beyond "Ransom" in section 6, and for the Afterword, were missing. They are now posted on Hogan's website and I reproduce them here:

Rasnick, David, 1996, "Inhibitors of HIV Protease Useless Against AIDS: Because HIV Doesn't Cause AIDS," Reappraising AIDS, August

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[2] This is no retraction of my oft-expressed opinion that John Ziman understands and has described (Ziman, 2000) the ins and outs of scientific practice, including the merging of "pure" and "applied" (Ziman, 1994), better than anyone. But Ziman has eschewed the issues of mainstream dogmatism, unwarranted suppression of unorthodox views, and public ignorance about competent dissident views.

[3] For detailed critiques of academic "science studies", see Bauer (1996, 1997). Many years ago, I had allowed myself to point out to the then-editor of the journal Public Understanding of Science that it seemed entirely unconcerned with what the public actually understood about science, or why, and that it was just another academic journal preaching to its own little choir. Whether I had a point or not can be judged by scanning the articles being published there (http://pus.sagepub.com/archive/).

My ire had been aroused because the journal had rejected an article, based on much gathering of actual examples, showing that "science" and "scientific" are used in more than a dozen disparate ways, some of them mutually incompatible. That still seems to me an important piece of information about the public understanding of science, and it clarifies the typical rhetorical resorts to "science" in public controversies; see chapters 1–3 of Bauer (2001b).

[4] While I believe that the substance of these heresies does not warrant attention, the social phenomenon of passionate support for them does, very much, warrant attention; see Bauer (1984/1999).

[5] See my review of Phillip E. Johnson, Darwin On Trial, in Reviews of Creationist Books, ed. Liz Rank Hughes (Berkeley, CA: National Center for Science Education, 2nd ed., 1992) 73–78; reprinted from Journal of Scientific Exploration, 6 (1992) 181–186; follow-up letters from Phillip Johnson and Henry Bauer are in Journal of Scientific Exploration, 6 (1992) 391–393.

[6] For a concise summary in this Journal, see Gishlick (2004); for critical reviews of a number of creationist and ID books, see Hughes (1992) and Moore (2003); for book-length criticism (including from religious believers), see Van Till et al. (1988), Miller (1999), Pennock (1999), and Miller (2001), which were reviewed in the Journal of Scientific Exploration, 17, 366–369 (by Henry Bauer), 143–149 (by Karl Fezer), 754–758 (by Keith Parsons), and 149–151 (by Henry Bauer), respectively. Pennock (2001) has also edited a book in which proponents and critics of ID address each other; see review by Keith Parsons in the Journal of Scientific Exploration, 17, 139–143.

Typical ID calculations are based on false premises. Some primitive initial conditions are assumed—in the limit, just the presence of the right atoms and molecules—and the probability is calculated that these self-assemble into some living creature. But atoms and molecules just do what atoms and molecules do, without benefit of "information" to guide them, and myriad reactions going on all the time around and inside us demonstrate that. The only probability one could hope to calculate validly is that for a single reaction-step; and even then, one needs to know the actual mechanism. Organic chemists know that their step-wise syntheses of complex molecules rarely if ever attain the efficiency of the same synthesis done by enzymes in living systems. No one should deny that the chemistry of living systems can only be marveled at; but that does not mean that naturalistic explanations for it cannot be found.

[8] Suggested by Lynn Margulis and strongly resisted by the mainstream until recently. As everyone should know but does not, initial resistance to brilliant insights is standard (Barber, 1961).

I am *parti pris* here: Ginenthal misrepresents what I wrote and fails to cite my book.

[10] In my book about Nessie (Bauer, 1986: 45) I had written "that 90 or 95 percent of UFO sightings have been explained as weather balloons [etc.] . . . convinces many people (including me) that there is nothing more than that to the whole business". That brought warranted criticism from Jerry Clark (1987). I had allowed myself to experience *conviction* after only superficial acquaintance with the subject. I had not known, for example, that the typical unexplained UFO sighting differs in many details from the explained ones, and, most tellingly, that it is some of the best accredited and detailed sightings that have never been satisfactorily explained.

[11] In 1988, I wrote, "I regard homosexuality as an aberration or illness, not as an 'equally valid life-style'" (Martin, 1988: 80). As with UFOs, I had acquired an opinion without really thinking about it, accepting the simplistic and superficial view that it could not be "natural" since it doesn't make for reproduction and the survival of the species. Since then I have come to understand how invalid are the (many, common) assertions that "evolution" would have done so-and-so and would never do such-and-such. I have also learned about the naturalistic fallacy, the belief that because something happens to be so, therefore it *should* be so; but culture and ethics are not wholly determined by biology, nor should they be. Looking into the HIV/AIDS controversy has had the beneficial side-effect of lessening somewhat my ignorance about homosexuality, thanks in particular to books by Lauritsen (1974) and Sullivan (1995). The latter is the most logically rigorous analysis of a social issue that I have encountered.

[12] As to the profound difference between 100% certainty and 99.99999 . . . %, see Bauer (2001b: 59–67).

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