

Government-Sponsored Perversity

Perverse Subsidies: How Tax Dollars Can Undercut the Environment and the Economy. Norman Myers and Jennifer Kent. Island Press, Washington (DC), 2001. 240 pp., \$40.00 (ISBN 1-55963-834-6 cloth).

Norman Myers and Jennifer Kent have written a comprehensive and engaging book about one of the biggest impediments to environmental quality and sustainability—perverse subsidies. The book does a splendid job of documenting and quantifying perverse subsidies in six main sectors globally. One thing it lacks, however, is a really concise definition of perverse subsidies.

Here is what is meant: A subsidy is a payment by a government to an individual or firm, the intent of which, theoretically, is to *decrease* the divergence between private and social costs and benefits—to internalize externalities. (An externality is a cost or benefit that is not paid for—i.e., it is external to the market. Private costs and benefits are usually internal, and social costs and benefits are usually external to the market.) A *perverse* subsidy is therefore a payment by a government to an individual or firm that, instead, *increases* the divergence between private and social costs and benefits. These subsidies can be direct or indirect.

Direct subsidies are direct government payments to agriculture, fossil fuel and nuclear energy, road construction, water, fisheries, and forestry (the six major sectors documented in Myers's book). Some of these subsidies are, of course, not perverse. They serve the intended purpose of reducing the divergence between private and social costs and benefits. But a large proportion of current direct subsidies are perverse. Myers and Kent estimate that globally 60 percent of conventional subsidies are perverse. This amounts to \$860 billion annually.

Indirect subsidies are the failure of government to internalize externalities (especially environmental externalities)—leaving an unaddressed divergence between private and social costs and benefits. All indirect subsidies are (by definition) perverse, and Myers and Kent estimate their total at \$1,090 billion annually.

The total direct and indirect perverse subsidies worldwide are therefore estimated to be almost \$2 trillion annually. As Myers and Kent point out, this is almost three times global military spending, larger than the annual sales of the 20 largest corporations, and four times the annual incomes of the 1.3 billion poorest people on earth. In other words, perverse subsidies are a huge problem, but an inherently solvable one, the elimination of which would yield a double dividend: It would first help to reduce the divergence between private and social costs and benefits, thus making the economy function more efficiently, and second, it would free up funds to help solve other pressing problems.

All of the perverse subsidies documented by Myers and Kent have either direct or indirect connections to environmental concerns. The largest category of perverse subsidies, according to Myers and Kent's estimates, is road transportation, at \$780 billion per year. Road construction directly destroys habitat (2 percent of total land area in the United States is covered by roads) and burning fossil fuels in cars causes a significant portion of total air pollution, including global warming—causing CO₂. The next largest category of perverse subsidy is agriculture, at \$510 billion per year. Agricultural subsidies lead to overuse of herbicides and pesticides and excessive soil erosion, among many other environmental problems. The next largest category is fossil fuels and nuclear energy, at \$300 billion per year. These subsidies lead to overconsumption of energy,

air and water pollution, and the failure to develop renewable alternatives. Likewise, perverse subsidies to water (\$230 billion per year), fisheries (\$25 billion per year), and forestry (\$92 billion per year) can be shown to be the causes of a host of significant environmental problems.

Critics will, of course, argue that these estimates are far too uncertain and “mushy” to have any meaning. Myers and Kent acknowledge the huge difficulties, but point out that

As long as the issue of perverse subsidies remains untackled, there tends to be an implicit presumption that their total must effectively be zero: There is the asymmetry of evaluation at distortional work. Of course, this is not what is intended. But as long as a problem is not accorded adequate attention, it is implicitly viewed as if it is not a problem at all. (p. 21)

Myers and Kent “resist the temptation to say we simply cannot appraise perverse subsidies in quantified fashion at all” (p. 21). Instead, they take on the challenge and ask the reader to accept the well-documented qualifications that must always accompany any difficult analysis such as this one. They also point out that their estimates are almost certainly conservative—further analysis and better data would reveal even larger numbers.

Why do perverse subsidies persist? The answer is obvious, given the way our political systems work. One example is enough to demonstrate the magnitude and recalcitrance of the problem. Between 1993 and mid-1996, the American oil and gas industry gave \$10.3 million to political campaigns and received \$4 billion in tax breaks (Drew 1999). This represents a benefit–cost ratio of about 400 to 1. Few investments in our economy are anywhere near as lucrative as this! Given these kinds of returns, it is little wonder that perverse subsidies exist and that they

will be very difficult to eliminate. But they can be eliminated if they are exposed to the light of day and if the substantial public benefits of their removal are brought into the political debate. Campaign finance reform is finally beginning to be seriously considered in the United States, and the removal of perverse subsidies could be next in line.

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THE WONDERFUL WORLD OF CICHLIDS

The Cichlid Fishes: Nature's Grand Experiment in Evolution. George W. Barlow. Perseus Publishing, Cambridge (MA), 2000. 335 pp., illus. \$28.00 (ISBN 0-7382-0376-9 cloth).

With wry humor, illustrative anecdotes, and an acknowledged tendency to anthropomorphize, George W. Barlow describes the reproductive behavior of cichlids from species recognition and mate selection to parental care of vulnerable young. Barlow begins by introducing us to the diversity of cichlids in terms of numbers, noting that they are changing as data from both field studies and molecular analyses are accumulated. The focus of his book is not so much the rapid evolutionary radiations of cichlids, "but [is] rather about what cichlids do

and what makes them so special" (p. 4). To understand why cichlids are special, however, one must first understand some of the basics of fish biology. The obvious starting point for the reader unfamiliar with fishes in general or with cichlids in particular is to learn exactly what a cichlid is. The clear explanations, descriptions, and simple, well-executed line drawings in chapter 1 set up the remaining chapters and will certainly be of value to the aquarist, introductory biology student, or interested reader whose ichthyology course was years ago.

The success of the cichlid fishes is due in no small part to their morphological adaptations to various sources of food (Galis and Metz 1998). In terms of trophic differentiation, cichlids may be, among other things, vegetarians, detritivores, corpse-mimickers, planktivores, or even scale rippers. Each specialized feeding style has associated with it particular jaw or behavioral adaptations, several of which are briefly described in chapter 2. Barlow is careful to point out, however, that even specialized cichlids are opportunists and can readily take advantage of an overabundant food supply should one appear. Cichlid success may also be associated with the ability of an individual to change its sex in certain conditions, a process perhaps best known from examples of tropical reef fishes. In the chapter titled "Plastic Sex," cichlids that are capable of changing their sex, including an African tilapia and an Asian chromide, are described, as are the effects of pH and water temperature on sex ratios. The concept of sexual plasticity may be new to some readers. It does, however, help explain why the two female Midas cichlids in your tank are suddenly rearing a clutch of fry in the absence of a known producer of sperm.

Mating systems, aggression, communication, and mate selection are the topics of chapters 4 through 8. Fertilization and care of eggs and fry are covered in chapters 9 through 11, and chapter 12 is the primary section in which potential processes underlying cichlid evolution are discussed. The closing chapter of the book, "Fish at Risk," is grim. In the vein of Rachel Carson's *Silent Spring* (1962),

we are warned that cichlid diversity is at risk in the great African rift lakes, not specifically because of DDT but because of the myriad ways humans use and abuse the lakes and their fauna. I was left with the feeling that we had better study every aspect of these fishes now, before it is too late. Barlow is understandably concerned; not only are existing species being lost, but additional speciation events may be inhibited (Galis and Metz 1998), cutting short "Nature's Grand Experiment in Evolution."

Behavior, specifically reproductive behavior, is the primary focus of this book. The material on cichlid reproduction (from mating systems through care of young) is both well presented and interesting, answering such diverse questions as these: How do monogamous mouth-brooding pairs form, and what are the costs associated with this form of reproduction compared with lekking mouth-brooding reproductive costs (chapter 4)? Does symmetry play a role in mate selection (p. 131)? Are the cichlids in your home aquarium fighting or preparing to mate (chapters 5 and 8)? How metabolically costly are aggressive and submissive behavioral displays (p. 213)?

Barlow reports research results from a wide array of studies performed on cichlids to address these questions and many others. His language is simple, and the descriptions of behaviors are clear and comprehensible. Line drawings complement the text.

Given the breadth of reproductive topics and the volume of pages devoted to this material, his book might have been better subtitled "Nature's Grand Experiment in Reproductive Behavior." Barlow does refer to evolutionary scenarios in several chapters, but evolution as a specific topic is the focus of only chapter 12. Because reliable phylogenies for closely related cichlids are lacking (reviewed in Kornfield and Smith 2000), it is difficult to be phylogenetically rigorous in a book of this type. Barlow generally avoids this stumbling block by focusing instead on the details of mating systems and reproductive behavior.

Leaving aside the idea of a change in title, I found this book enjoyable for a very

specific reason. I have heard it said by a few of my non-research-oriented friends that most of the interesting questions in the basic sciences have been asked, and that what remains to be addressed is, by and large, the minutiae. Scientists, natural historians, and those fascinated by life beg to differ. Barlow challenges this intellectual ennui in every chapter of his book, littering the pages with interesting question after interesting question. For example, have several parental cichlids evolved special cells called secretocytes to feed their young, as has been observed in the discus *Symphysodon aequifasciatus*, or is this an autapomorphy for the taxon (p. 196)? Does the genital tassel that develops in male *Nyasalapia (Oreochromis) rukwaensis* (Figure 9.5) form via the developmental process of branching morphogenesis, as the line drawing suggests? To what extent do cichlids disperse in response to ecological perturbations (see p. 239 for a ready-to-go field research project)? The discerning reader can find ideas for interesting and novel research projects for fields ranging from evolution to physiological behavior to developmental biology.

Many of the questions presented throughout the book are amenable to short-term, classroom-type experimentation; this book would be a valuable supplement to an introductory animal behavior lab course at the undergraduate level. The African Lakes currently suffer significant abuses, including overharvest of fish for the aquarium trade, and I caution every interested course instructor to restrict experiments to species that are readily available from hatcheries or that are obtained from sources that spawn their own stock.

A final note to the aquarists: You will enjoy the book as much as, if not more so, than the average biologist. The color plates are beautiful and many species will be recognized by cichlid aquarists. Tank behavior, aggressive displays, failure of a single male and a single female to bond, all are addressed anecdotally, and a fairly extensive reference section can direct the interested reader to the original literature. The glossary will be of use as well. Although Barlow clearly defines unfa-

miliar terms upon first use, it is helpful to double-check differences between such terms as polyandry, polygynandry, and polygyny as one reencounters them.

Cichlids, especially those found in the great lakes of Africa, have provided scientists with an excellent opportunity to study behavioral evolution, speciation, reproductive strategies, and other topics. Barlow describes the many aspects of cichlid fishes that underlie their diversity, while warning us, as have others (Galis and Metz 1998), that cichlids and cichlid diversity are certainly at risk. This book is likely to be of value to aquarists, ichthyologists, behavioral biologists, and perhaps to evolutionary biologists (though it is not phylogenetically rigorous), and is sure to be enjoyed by those whose interest in and fascination with life mandates curling up with a good biological read whenever one presents itself.

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“INTELLIGENT DESIGN THEORY”

Icons of Evolution: Science or Myth? Why Much of What We Teach about Evolution Is Wrong. Jonathan Wells. Regnery, Washington (DC), 2000. 338 pp. \$27.95 (ISBN 0895262762 cloth).

Because there are omissions, simplifications, and inaccuracies in some general biology textbooks, obviously the modern theory of evolution must be

wrong. This is the astounding line of reasoning that is the backbone of Jonathan Wells's *Icons of Evolution*. It is the latest book in a series of neocreationist productions (this one dressed with the slightly more respectable label of "intelligent design theory" [Pigliucci 2000a]) to drive a stake into the perceived perniciousness of modern science, and of biology in particular. This is another astonishing example of the fact that evolution deniers seem to consider attacks on science popularizing to be genuine intellectual feats, as if they had found huge holes in the primary literature that constitutes the core of any respectable science.

Wells is a fellow of the Center for the Renewal of Science and Culture, which has been at the forefront of the neocreationist assault on science over the last few years. Predictably, his book is endorsed by other fellows of the same institution and by luminaries of the evolution-deniers movement such as Michael Behe (author of *Darwin's Black Box*), Phillip Johnson (*Darwin on Trial* and *The Wedge of Truth*, among others), and Dean Kenyon (*Biochemical Predestination* and *Of Pandas and People*). Wells himself seems particularly well positioned to engage in this never-ending debate, given his double PhD in theology and molecular biology. Alas, *Icons* falls far short of a critique of evolutionary theory, or indeed of any significant contribution to the "evolution wars."

Wells's idea is simple: In the 10 chapters that make up most of the book, he tackles an equal number of what he calls "icons"—that is, myths—of evolutionary biology, attempting to show that biology textbooks don't tell the whole story, are out of date, or oversimplify what is known. From there he concludes that because these icons are the best "proofs" of evolution, biologists don't have a leg to stand on and they should once and for all abandon their ideological positions and open their minds to a truer and better science, which of course must include the possibility of intelligent supernatural design (Dembski 1998).

There are several flaws with this line of reasoning, which I shall examine in turn. First, textbook examples are no proof of anything. Second, Wells's critique of the

ten icons is much less devastating than he seems to think. And third, science simply doesn't work the way Wells apparently conceives it.

The fact that science (not only biology) textbooks contain plenty of oversimplifications and inaccuracies, and occasionally even major conceptual errors, is not news to anybody and has always been decried by professional scientists and educators. There are sadly understandable reasons for this state of affairs. For one thing, general science textbooks are written by people who either are not practicing scientists or are directly competent in only a fraction of the topics covered. Even when several authors collaborate, the situation does not improve significantly. Second, textbooks (unlike technical research books) are written largely to make money, both for publishers and for authors, and academic rigor sometimes gets sacrificed to accommodate more pressing matters, such as publishing deadlines. Third, pedagogical efficacy is often considered—rightly or

not—more important than scientific rigor; after all, the audience is made of young students with little background in the discipline to be studied, not of professionals who understand the subtleties of the subject matter. Regrettable as these facts may be, to conclude from them that evolutionary biology is a big lie constructed on thin evidence is analogous to the preposterous suggestion of abandoning, say, quantum mechanics because many physics textbooks do not portray it accurately or may even make egregious conceptual mistakes in explaining it. It just doesn't follow, and it is pure wishful thinking on Wells's part to pretend otherwise.

As for the icons themselves, I will limit myself to a brief discussion of a couple of them (I provide a more detailed, chapter-by-chapter analysis at the Web site fp.bio.utk.edu/skeptic/Debates/Wells%20guide.htm). Let me therefore consider the first and last—and perhaps the most important—of the icons: the Miller-Urey experiments on the origin of life, and the current status of the research on the origin of humans.

As is well known, in 1953 Stanley Miller—at the time a student of Harold Urey—published a historic paper in which he demonstrated the possibility of the inorganic synthesis of some of the fundamental building blocks of life, given conditions that were thought to resemble those of the ancient earth. This experiment is still presented in many textbooks as the scientific answer to the question of the origin of life. And Wells is right in maintaining that it shouldn't be. For one thing, even if we do accept Miller's results at face value, they are far from constituting an answer to the origin-of-life question. At most they provide an interesting beginning. More important, the recent consensus among geochemists is that the ancient earth atmosphere was essentially chemically neutral, not reducing like the one Miller simulated.

However, textbooks should still devote space to Miller's experiment for its historical (and pedagogical) value: It was not only the first modern piece of empirical research on the origin of life, thus moving the whole field out of metaphysical speculation, but also a great ex-

ample of how science progresses by questioning its own assumptions and results.

As for this being an icon of evolution in Wells's sense, there are two problems with his position. First, Wells gives his readers the completely misleading impression that the field of research on the origin of life is still at the level of Miller's 1953 experiment and that, given the questionable validity of the latter, the whole enterprise is in disarray. *Au contraire*, this is an area of extremely fecund theoretical and empirical activity, with new hypotheses, findings, and experiments being published at a very rapid pace (Lahav 1999, Fry 2000). More to the point of the creation–evolution debate, the Miller experiments and the whole question of the origin of life have nothing to do with the truth, or lack thereof, concerning evolutionary theory. By definition, evolution is something that happens *after* life originates on a planet and cannot be invoked to answer the question of *how* this happened. By the same token, evolutionary theory cannot be blamed for not being able to answer the questions of the origin of life, even if that question might remain a mystery forever. It is certainly true, as creationists are fond of saying, that evolution requires life to have originated, but the two are entirely discrete scientific questions addressed by different fields of research. For that matter, evolution also requires a universe to exist beforehand, but nobody would say that failure to understand the origin of the universe deals a fatal blow to Darwinism (actually, naive young-earth creationists such as Duane Gish do, but that is another story; Pigliucci 2000b, Chapter 11).

The “ultimate” icon in Wells's book concerns the story of human descent. This is perhaps one of the most peculiar chapters in the entire book, because even Wells is forced to concede ample ground to the evolutionists! He begins the chapter with the usual complaint about the naive scientists that were fooled by the Piltdown man hoax in 1912. I know of several scientists who feel the sting of shame—which Wells wants them never to forget—because science was duped by a fraudulent fossil. But Piltdown man was neither the first nor the last practical joke scientists will ever face. Furthermore,

it is yet another beautiful example, one that textbooks should promote, of how science really works. It is true that this alleged missing link between humans and chimps was more or less accepted (though not without challenge) for several decades. However, it is also true that the human fossil record at the time was so scant that it was very difficult to raise substantive objections to the Piltdown findings. More important, scientists—not creationists—uncovered the hoax, a development prompted by the very fact that more and more discoveries of genuine human and protohuman fossils made it quite clear that Piltdown didn't fit anywhere in the emerging picture. Because science works through consilience of evidence (Wilson 1998), it was the progress of science in virtue of its self-correcting mechanisms that prompted evolutionists to reject Piltdown and eventually uncover the fraud. I have yet to find a similar example of acknowledgment of error in the evolution-

denying literature, despite the fact that such errors have been ubiquitous in that literature.

Wells, as much as he desperately tries to debunk what to him is the most crucial component of evolutionary theory—the history of human descent—is backed against a wall by his own knowledge of biology. Unlike more naive creationists, he has to grudgingly admit that “many human-like fossils have been found since 1912, and unlike Piltdown they appear to be genuine. Some have distinctively ape-like features, while others are more human-like” (p. 218), and that “obviously, the human species has a history” (p. 223). So much for destroying the ultimate icon.

But perhaps the most damning point about Wells's book is the general conception of science that emerges from it. Given his scientific training, Wells should have known better. It is clear that the education system at Berkeley has failed in his case or that Wells does indeed have an

ideological agenda (which he was forced to admit in a public debate with me at the University of Tennessee; see <http://burns.tns.utk.edu/research/cb/evdebate.htm>). Wells's whole argument hinges on the idea of *the* crucial proof of a scientific theory. If that pillar fails, the whole enterprise is useless. Now, Wells is far from showing that *any* of the icons are in fact fundamentally flawed or represent an insurmountable obstacle for evolutionists. But even if he succeeded, Wells's conception of science is so simplistic as being labeled by philosophers of science as naive falsificationism.

Falsificationism, it may be recalled, is the idea proposed by philosopher Karl Popper (1968) that no amount of positive evidence is enough to sustain a theory unless such theory also makes predictions that could—in principle—be demonstrated to be wrong, that is, the theory is potentially falsifiable. Popper, however, did not advocate discarding a scientific theory at the first sign of trouble. Indeed, Thomas Kuhn (1970) clearly showed that real science is a lot more messy and that before switching paradigms the amount of trouble has to be substantial, or one risks living in a perennial state of flux in which no progress is actually possible. The real “evidence” for evolution is not to be found in individual experiments, and it is certainly not to be expected in textbooks for beginning students. Rather, it is found in the

plethora of facts about the biotic world that accumulate every year in the primary literature, facts that make no sense outside of the evolutionary paradigm. Components of this paradigm are constantly being tested in countless laboratories around the world, and—for the most part—the theory has withstood the test of time. More important, this is the way science really works, regardless of Wells's naive and ideologically motivated views that it should be otherwise (he admits in an online article, available at <http://www.tparents.org/library/unification/talks/wells/DARWIN.htm>, that he enrolled in his second PhD program—in molecular biology—for the express purpose of “destroying Darwinism”).

What have we to learn from this latest attempt at debunking evolution? Two things. First, that it is indeed a good idea to pay more attention to how our textbooks are written. This is not just so that individuals like Wells will not be able to use their cheap ammunition in a public debate, but because the so-called icons can be properly used to show students that science is an engaging and ever-changing enterprise, not a monolithic block of static knowledge. Second, we should finally get the message that evolution deniers are always at work, and that they are making inroads with both the public and politicians. How long until we climb down from the ivory tower

and start defending—and doing a better job of teaching—reason and science?

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