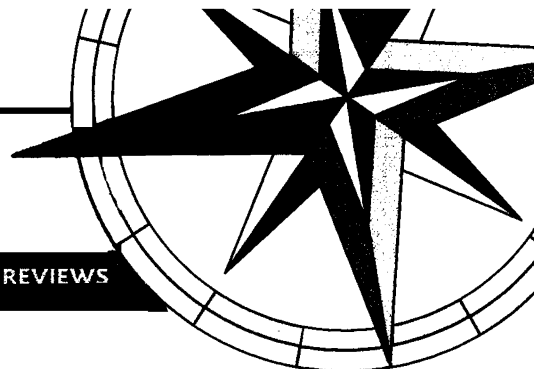




A Comprehensive U.S. Energy Policy

IN HIS EDITORIAL "MEETING THE ENERGY challenge," John P. Holdren forcefully made the case for "...increased efforts to maximize the capabilities and minimize the liabilities of the full array of energy options..." (*Science's Compass*, 9 Feb., p. 945). But Holdren did not recommend on whom or on which institution these responsibilities should be placed. Energy is the ultimate resource of humankind, as the supply of all other necessities of life, such as potable water and clean air, can be enhanced with the availability of energy. Moreover, access to energy determines, to a considerable extent, the distribution of political power; the accident of nature that located vast petroleum reserves in dictator-led and warlike nations plays a large role in international affairs, as well as in the disposition and size of military forces.

If somewhere within the executive and legislative branches of the U.S. federal government there exists a comprehensive energy policy—one that encompasses economics, ecology, international relations, and the military—I have never found it. Holdren's editorial should be perceived as a plea for just such a policy for the United States.

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HOLDREN WISELY AVOIDS GETTING INTO THE morass of cultural factors that affect the usage and management of the U.S. energy supply. However, the effect of one such factor is so profound that it cannot be ignored: states' rights in regulating electricity supply and prices. It made sense to leave such regulation to the states when electricity was generated and mainly used locally. Now, however, electricity is bought

from generators half the nation away from the points of end use, and transported through a nationally connected electric power grid. In these circumstances, the action of any state can profoundly affect the electricity supply and prices in a large fraction of the nation (1).

We have seen this effect in the recent California debacle, where the governors of several other western states expressed concern about California's impact on their own state's electricity supplies and prices. Surely, this aspect of energy supply should qualify for federal action under the interstate commerce clause of the U.S. Constitution (2), to ensure efficient and equitable distribution of electricity from a secure, nationally guided electric power generation and distribution system, much as we manage the interstate

transportation systems. Yet this need has nowhere been mentioned in any public discussions of the California electric power crisis and its aftermath.

This seems to be a clear case of our ideology getting in the way of our common sense, to the detriment of our national welfare.

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Portugal: A Case History in S&T Cooperation

IN 1989, FORMAL UNITED STATES-PORTUGAL cooperation in science and technology (S&T) was almost nonexistent. Within Europe, only the former German Democratic Republic had less scientific contact with U.S. S&T agencies. A dozen years later, it would seem that not much has changed. A recent search of the U.S. Department of

State's long list of bilateral science agreements finds just one agreement between Portugal and the U.S. National Oceanic and Atmospheric Administration (1).

A handful of staffers at the U.S. Department of State and some of the U.S. science agencies saw this imbalance in 1989 and tried to change it by drafting proposals for an "umbrella" S&T agreement with potential funding from the Lisbon-based Luso-American Development Foundation (1). The idea made it as far as the briefing books for the 11 January 1990 meeting between then-President George Bush and Prime Minister Anibal Cavaco Silva. But no farther.

Perhaps it is time to try again. Portugal has applied European Union funds and internal reforms to build a well-equipped, Internet-connected S&T base. Richard Stone's News Focus article ("Portugal: Money and charisma help the science tide come in," 9 Mar., p. 1889) pointed out a

"A recent search...of bilateral science agreements finds just one...between Portugal and the [United States]"

number of potential areas for bilateral cooperation. Others areas include genetics, cancer, archaeology, geology, tropical medicine, and HIV-2 research in Luso-phone Africa. There were good reasons for

Letters to the Editor

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encouraging cooperation a dozen years ago. Those reasons are still valid today and opportunities for mutually beneficial research are even better.

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Tracking Antibiotics Up the Food Chain

AMONG THE COSTS OF USING ANTIBIOTICS IS the gradual loss of their effectiveness as bacteria evolve resistance to them. S. Falkow and D. Kennedy suggest in their Editorial "Antibiotics, animals, and people—again!" that the best policy to minimize these costs for a class of antibiotics called fluoroquinolones is to ban their use in farm animals (*Science's* Compass, 19 Jan., p. 397). But evidence does not support their analysis. The suggested policy would deny the public benefits of antibiotic use in animals without materially extending effective use of these drugs in humans.

From our perspective as professional risk analysts, the Editorial presents a flawed diagnosis of the problem. Falkow and Kennedy blame increasing antibiotic resistance on veterinary use because resistance has increased in humans while fluoroquinolones

The use of antibiotics in animal husbandry benefits the public in several ways. It can reduce the cost of meat and the numbers of infective microbes in food (5). People are healthier as a result. The U.S. Food and Drug Administration (FDA) should develop an approach to managing antibiotic use that allows us to reap the benefits of these drugs while maximizing their effectiveness. Recent CDC data now being analyzed might allow the FDA to do so. Effective policy-making cannot be based on logic that attributes blame for rising resistance to relatively minor use of antibiotics in animals while neglecting the far more likely cause represented by increasing use in humans.

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"[P]olicy-making cannot be based on logic that attributes...rising resistance to relatively minor use of antibiotics in animals"

"800 tons of fluoroquinolones are used annually in humans, 120 tons in animals; the latter use, hardly minor, threatens the former."

lines are being used to treat poultry. Our analysis of the Center for Disease Control and Prevention (CDC) study and other published results suggests that the evolution of resistance to fluoroquinolones in human commensal bacteria arises independently of use in animals. Strains of *Campylobacter jejuni* resistant to fluoroquinolones existed before this use. The prevalence of resistant strains in people increases at roughly the same rate in countries that do not use fluoroquinolones in farm animals as in countries that do (1), whereas resistance in farm animals has no obvious association with use in farm animals (2). Indeed, as inoculation theory predicts, the presence of *C. jejuni* strains in chickens protects those who handle (3) and eat (4) the infected birds against severe diarrhea and campylobacteriosis.

Response

WE POINTED OUT IN OUR EDITORIAL THAT 25 years ago the issue of antibiotics in animal feeds had become an argument in which scientific evidence defaults to risk assessment. The response by Daniel Byrd and co-authors suggests that times haven't changed. They argue that the benefits of continued use of fluoroquinolones in animals outweigh the costs to human and animal health. To support that case, they assert that the use of fluoroquinolones in animals is "minor," while ignoring its human uses.

In fact, 800 tons of fluoroquinolones are used annually in humans, 120 tons in animals; the latter use, hardly minor, threatens the former. Byrd *et al.* point out that resistance to fluoroquinolones in human commensal bacteria arises independently of fluoro-

quinolone use in animals. That is correct, but irrelevant to our case; the question is whether the animal uses *add* to the resistance load. The weight of epidemiological evidence shows that food of animal origin is the source of most food-borne bacterial infections caused by *Campylobacter* (as well as nontyphoid *Salmonella*, *Yersinia*, *Escherichia coli* 0157, and other pathogens). So the question is whether the use of these drugs in animal feeds contributes to the increase of resistant *C. jejuni* and *E. coli*. Such increases were seen in Europe after the introduction of enrofloxacin in veterinary medicine, and again in the United Kingdom after the approval of quinolones for the same purpose. The increase in the United States reported in our Editorial was the third case, and one can only hope it will be the last [see (1) for an authoritative review of these human costs].

To buttress their case for benefits, Byrd *et al.* say that the presence of *C. jejuni* strains in chickens protects handlers and consumers against severe diarrhea and campylobacteriosis. Actually, between 60 and 80% of chickens sold for consumption in U.S. supermarkets have some *Campylobacter* contamination. Antibiotic use has little effect on that proportion, but what it does do is to make more of the bacteria antibiotic-resistant. The data we cited show that the eventual result is an increase in the proportion of resistant pathogens in people who are buying and eating the chickens. There are about 2.4 million cases of *Campylobacter* disease in the United States each year (2). Clearly, exposure to these bacteria is not a protective event. Why Byrd *et al.* count it as a benefit is not clear.

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Taiwan Seeks to Solve Its Resistance Problems

THE IMPORTANT ROLE OF FOOD ANIMALS IN antibiotic resistance was emphasized in the Editorial by Stanley Falkow and Donald Kennedy. Taiwan has had a serious antibiotic resistance problem for many years. In 1997, the National Health Research Institutes (NHRI), an institute modeled after the U.S. National Institutes of Health, established a program to address it. The program