

of the conversations Brenner and his friends had about what they knew, what they didn't know, and what was the next important question to tackle. It also offers readers a broad sample of Sydney's pun-gent opinions on scientists and science:

If you simply say, "Development is just a matter of turning the right genes on in the right place at the right time and that's the answer," that's absolutely true. But it's absolutely useless because somewhere deep down what we'd really like to do is to actually go and make a mouse...Of course no one will build a real mouse, but we'd like to be able to make a gedanken (imaginary) mouse."

I last saw Sydney a few months ago at a dinner honoring the participants of a 1985 conference that was the first to examine the feasibility of a human genome project. As the speeches droned on and on, he sat at the next table, constructing something with his napkin (perhaps it was a mouse). He winked when our eyes met, and I thought of Kokopelli—the mythic musician, trickster, and sower of seeds of the American Southwest whose flute songs beguile the people and bring the rain.

Near the end of the book, Brenner comments that he hates writing but is good at talking. This no doubt explains why *My Life in Science* was compiled from videotapes. I was very disappointed that the "accompanying video" mentioned in the preface was not available for review. I would love to see and hear Sydney once again expounding on some topic. Any topic.

BOOKS: CLIMATE

Why Global Warming Is Controversial

George Philander

Suppose we are in a raft, drifting toward a waterfall. To avoid a calamity, we must address two questions: How far is the waterfall? And when should we get out of the water? We deal with these questions in radically different ways. The first can be answered with the methods of science. The second (a matter of policy) is far more difficult. It has a multitude of possible answers, none entirely satisfactory to everyone, and it requires compromises among the different values of different people (some timid, some foolhardy). The difference between the science and policy as-

pects of environmental problems is sharp in this allegory, but the distinction can easily become blurred when the scientific results possess uncertainties. Controversies are common when it is unclear whether disagreements about the distance to the waterfall reflect scientific or political differences.

Changing the Atmosphere demonstrates convincingly that in the current debate about global warming the distinction between science and policy is almost absent. Edited by Clark Miller (a political scientist at the University of Wisconsin-Madison) and Paul Edwards (the director of the Science, Technology, and Society program at the University of Michigan), the book comprises ten essays on the interactions between the atmospheric sciences and public policy. In their introduction, Miller and Edwards state that, today, environmental "science's place in global policymaking is increasingly formalized, boosting its authority in policymaking processes but also subjecting it to new forms of political and legal oversight and review. International expert institutions such as the IPCC (Intergovernmental Panel on Climate Change) increasingly determine which knowledge counts and which does not, helping to shape crucial policy outcomes." In a later chapter, Edwards and Stephen Schneider describe the IPCC as a "hybrid scientific/political organization"; it involves hundreds of scientists and several nonscientists from all over the world in evaluating and synthesizing the scientific understanding of global climate change. That the IPCC is controversial is thus no surprise. Dale Jamieson tells us that many people regard it as "the voice of reason and dispassionate objectivity," but that others who disagree with its findings consider it a "malevolent conspiracy."

Several of the essays provide an excellent summary of how this state of affairs developed. After World War II, the creation of an integrated, global, observational network to monitor the weather was intimately related to the efforts of politicians to reconstruct a stable world order by promoting international cooperation in science and technology. An intriguing interplay between science and politics transformed weather and climate from local into global phenomena, thus setting the stage for global climate change to become an international issue. In dealing with this complex problem, a distinction between its science and policy aspects would be helpful. Several authors of this book seem to believe that, in the case of global warming, such a distinction is impossible. However, the arguments of these experts from the field of "science studies"

are marred by misconceptions concerning models of weather and climate.

The discussions of models, except for Stephen Norton and Frederick Suppe's consideration from the perspective of philosophers of science, are poor. A major reason is a failure to explore why, at present, climate models have far larger uncertainties than those that predict the weather. Weather forecasts used to be regarded as auguries, but now are accepted as sources of reliable and important information. In early November 2001, for example, forecasts for Hurricane Michelle prompted the governor of Florida to order the evacuation of the Florida Keys. (Even though the order proved unnecessary on that particular occasion, it will be repeated under similar conditions in the future.) The advances in weather prediction that cause such predictions to be widely accepted were possible

because the time scales of the phenomena of interest (a few days) are so short that the data collected over the past few decades provide stringent tests for the predictive models. Unfortunately, the instrumental records are too short to provide similarly demanding tests for models that predict climate changes decades hence. Scientists are therefore turning to the geological records (which are not mentioned at all in this book) that describe dramatically different climates in the past.

Of particular interest is Earth's response to slight fluctuations in orbital (Milankovich) parameters such as the tilt and precession of its axis. Over the past few million years, the amplitude of that response has increased significantly, and it now includes recurrent Ice Ages. Why Earth's climate is currently far more sensitive to this modest Milankovich forcing than in the past is, as yet, unknown. But this sensitivity is ample reason to be concerned about the current exponential rise in the concentration of greenhouse gases in the atmosphere. (Most of the book's authors seem to believe that the basis for concern stems strictly from the results of climate models.) Confidence in the theories and models for future global warming will be bolstered significantly once we have explanations for and simulations of the Ice Ages.

Coping with global warming will require the collaborative efforts of people with diverse backgrounds. In *Changing the Atmosphere*, experts in science studies alert us to the current absence of a clear distinction between the science and policy aspects of global warming. They apparently believe that this will always be the case.

Changing the Atmosphere Expert Knowledge and Environmental Governance

Clark A. Miller and
Paul N. Edwards, Eds.

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Scientists need to respond. The development of climate models that estimate the distance to the waterfall with greater accuracy will contribute considerably to a more constructive debate about how and when we should get out of the water.

BOOKS: PHARMACOLOGY

The Pill in Context

Londa Schiebinger

Hailed as a panacea for the world's burgeoning population woes when it was released some 40 years ago, the contraceptive pill has now been taken by some 200 million women. An estimated 70 million women will take their "pill" today. In *Sexual Chemistry*, Lara Marks, a historian of medicine at London's Imperial College, places the history of the pill in a rich context that considers sexual customs, religious attitudes, and government support for family planning—all of which have influenced the fate of this 1/4-inch-in-diameter cultural artifact. As Marks points out, the pill revolutionized contraception: it could be taken conveniently by

mouth, it could be taken at any time of day so as not to disrupt the spontaneity of the sexual act, and it could be taken without the knowledge of the male partner.

Much has been written about the pill. One fresh aspect of Marks's account is her discussion of how innovations in packaging eased usage. Despite its many advantages, the pill was still fairly complicated to take. A woman had to remember to take one each day, starting and stopping the cycle of pills in relation to her own menstrual cycle. David Wagner, who designed the special "Dialpak" (a circular design that became widely copied and used by the mid-1960s), did so as a result of arguments he had had with his wife about whether she had remembered to take her pill. According to Marks, this pharmaceutical packaging was the first deliberately designed to aid patient memory. The pill was also one of the first prescription drugs, after isoproterenol inhalators, to be marketed with package inserts warning of its health risks, which included thrombosis and severe allergic reactions.

One of Marks's purposes in writing this book is to challenge the notion that the pill was primarily a U.S. innovation. Much like

Nelly Oudshoorn's *Beyond the Natural Body* (Routledge, London, 1994), *Sexual Chemistry* focuses on the contributions made by the European sex hormone industry in the 1930s and by scientists who, fleeing fascism, found asylum in the Americas. Marks also wishes to draw attention away from the canonical "fathers" of the pill—Gregory Pincus, Carl Djerassi, and John Rock. She highlights the contributions of Margaret Sanger, feminist advocate of birth control, and Katherine McCormick, the second woman to graduate from the Massachusetts Institute of Technology. Heiress to a magnificent fortune, McCormick provided two million dollars for research and development of female oral contraceptives beginning in the 1950s, when such research was still prohibited by the Comstock laws in many parts of the United States and the pharmaceutical companies were reluctant

1940s because he had read about *cabeza de negro* in a botany book. This wild Mexican yam seemed a possible ample source of sapogenins, which offered an alternative to cholesterol as the raw material from which progesterone could be synthesized.

By starting her account in the early 20th century, Marks has also left out the rich history of fertility control practiced by women throughout Latin America. Naturalists traveling in the area from the 16th through the 19th centuries—among them, Maria Sibylla Merian, Sir Hans Sloane, and Alexander von Humboldt—expressed surprise that indigenous and African slave women used both abortifacients and contraceptives. These women successfully employed various roots, flowers, and seeds to control their childbearing. In her story, Marks overlooks the fact that Latin American women may have provided clues to an abundant and cheap source

of diosgenin, the sapogenin that was used in the development of the first marketable pill—and did so in an era when progesterone was prohibitively priced at \$1000 per gram.

Marks provides much information on the economics of the birth control pill. Not surprisingly, pill use is highest where public assistance or private insurance support is greatest. Although British women have had free contraception since 1974, many U.S.

women still bear these costs. That the pill must be purchased on a regular basis

goes a long way toward explaining why so many women in developing countries continue to use intrauterine devices and sterilization.

Some people continue to believe that science is "value-free," and that research results are about truth, nature, and knowledge. Marks's *Sexual Chemistry* tells a tale of competition among firms, of political suppression and religious objections, of problems with protocols for human testing, and of controversy over cancer risks—all of which begin to overshadow what we might think of as technical questions about human fertility and its control in the development of the pill. Without McCormick's money, a birth control pill might not have become "one of the most important landmarks" in the 20th century; at the same time, McCormick insisted on a female pill, seeing as essential women's ability to determine their own reproductive destiny. What might become the determining factor allowing men to share in this right and duty in the 21st century?

Sexual Chemistry
A History of the
Contraceptive Pill
by Lara V. Marks

Yale University Press,
New Haven, CT, 2001.
384 pp. \$29.95, £20.
ISBN 0-300-08943-0.



Pictorial instruction. Posters like this were distributed to teach Malaysian women how to use the pill.

to enter the field because they feared public controversy and a Catholic backlash.

There are, however, other unsung heroes and heroines who do not show up here. Marks endeavors to develop an international framework for understanding the origins of the pill, but she does not discuss some Latin American perspectives on the history. In these accounts, the American organic chemist Russell Marker, while traveling in a remote part of Oaxaca in 1949, "discovered" the yam barbasco (*Dioscorea mexicana*) when he observed his Mexican guide making tea from its root. Barbasco provided a cheap source of the steroidal hormones needed to jump-start the production of a widely marketable contraceptive pill. Its discovery was the key that allowed Marker to break the European monopoly on hormone production; unlike the research findings of the European companies, the Mexicans' traditional knowledge was not protected by patents. According to his own typewritten account (housed in the Pennsylvania State University archives), Marker had gone to Mexico in the

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