BOOK REVIEWS

Growing Concerns

The Lives to Come. The Genetic Revolution and Human Possibilities. PHILIP KITCHER. Simon and Schuster, New York, 1996. 383 pp., illus. $25. ISBN 0-684-80055-1.

Double-Edged Sword. The Promises and Risks of the Genetic Revolution. KARL A. DRLICA. Helix (Addison-Wesley), New York, 1996. x, 242 pp., illus. Paper, $13. ISBN 0-201-40982-8. Reprint, 1994 ed.

Improving Nature? The Science and Ethics of Genetic Engineering. MICHAEL J. REISS and ROGER STRAUGHAN. Cambridge University Press, New York 1996. x, 288 pp., illus. $24.95. ISBN 0-521-45441-7.

A genetic revolution has been occurring in biology for several decades, and it is rapidly affecting the population at large. The development of the Human Genome Project is fueling the revolution, accelerating the discovery of new genetic connections to old human problems. First, the targets will be the genetics of disease, then the genetics of deviant behavior, and then, as many feel is likely, the genetics of human enhancement. This revolution will create a myriad of social and ethical quandaries, with unintended consequences for individuals, families, and society, not only for our generation but for "the lives to come." It is clear that decision-making around genetics cannot be left only to the scientists but must include policymakers, consumers of genetic services, and just plain folks.

But the territory of the new genetics is not straightforward, and finding one's way through it can be a complicated and challenging endeavor. The three books reviewed here can be seen as bioethical guidebooks, each including a brief introduction to the genetic geography of the territory and well-developed discussions of the social and ethical pitfalls that confront us as we travel through it.

These books are intended for lay people and professionals alike. They cover an overlapping territory, but with different emphases. Kitcher offers reasoned ethical guidance about genetic issues for policymakers and concerned laypeople, Drlica emphasizes practical applications especially for consumers and their families, and Reiss and Straughan set their lens both more broadly, as they include other species, and more narrowly, focusing specifically on potentials and pitfalls of genetic engineering.

To make their arguments comprehensible (and to some readers credible), the authors need to explain how genes work and how they are being sequenced in enough detail to allow nonspecialists to comprehend the issues that genetics raises. All the books present the science of genetics reasonably, but it is, ironically, Kitcher, a philosopher by training, who explains the basics most clearly and directly.

Many of the issues raised around the new genetics are already familiar, such as privacy and genetic information, but are sufficiently contentious and unsettled to need reairing. While scientists and physicians tend to frame all the dilemmas raised by genetics as bioethical issues, it may be useful to differentiate between ethical and social problems. Ethical issues include questions centered on genetic testing and decision-making, privacy of genetic information, potentials of human enhancement, and consent for genetic intervention. Social problems generated by genetics include how much society should invest in genetics, the impact of genetics on our thinking about human problems, genetic stigmatization, the effects of genetic discrimination in jobs and insurance, and the like. Bioethics focuses primarily on the individual, subsuming the social context. While there is considerable overlap (as in the case of eugenics), such a delineation allows more attention for the social and political dimensions of genetics.

Kitcher specifically begins to address the social questions in several chapters. In "Delimiting disease" he raises the often overlooked issue of how certain conditions become defined as "defect" or disease. Although in many areas distinctions seem clear, constructivists about disease have pointed out (sometimes to extremes) that what is a disease is at least in part a social designation. There are shadow areas where lines can be drawn, and here definitions of genetic "defect" ultimately "turn on a social consensus about what kinds of lives are valuable." It is by understanding this context that we can evaluate prenatal testing and genetic interventions; Kitcher partially sees the way out of this morass, by asking how would interventions "affect the quality of future lives."

In "Fascinating genetalk" Kitcher asks what we mean by saying we have identified a gene "for" a particular disease or problem. He rightly argues that scientists and lay people are much too cavalier about attributing genetic causation. He shows how we leap from a genetic association to assume there is a gene *for* a particular trait; we've seen this recently with the so-called "gay gene" and "obesity gene." He reframes the old nature-nurture issue by suggesting that even when there is demonstrated genetic causation, we need to recognize that this means that the genes are associated in the context of a "standard environment." For example, in cases like phenylketonuria the genetic propensity for disease is not manifested under a specific dietary environment. Particular environments may be as necessary as genes. Yet we don't talk about an environment for this or that genetic condition. Loose genetalk by scientists, media, and the public privileges the influence of genes and overemphasizes the role of genetics in human life.

While Kitcher raises trenchant social and policy issues about genetics in all its manifestations, Reiss and Straughan have more circumscribed goals. They examine the major implications of genetic engineering. They point out that we have been engaged in forms of genetic engineering for centuries, especially through plant and animal breeding. But they show how the new genetic engineering is different, not only in that it is more precise and specific but in that it can cross species barriers, which have evolved over millions of years. The book includes ethical concerns for the whole spectrum of life—including microorganisms, plants, animals, and human beings—and is rich with extended examples, from human insulin to tastier tomatoes to pigs for organ transplants to human somatic and germline engineering. The authors recognize that ethics can't provide conclusive answers about the rightness and wrongness of genetic engineering, but they clearly present the risks and benefits that inhere in creating genetically altered organisms. At best we have life-saving and life-enhancing interventions; at worst, we risk creating genetic Frankenstein monsters. The choices are still in our hands; this book can help us make them more intelligently.

Drlica writes specifically for "consumers," people who will need help making decisions and interpreting information from genetic advisers. He understands well that the genetic revolution is a "two-edged sword," with the potential to eradicate some disease and the ability to stigmatize individuals and families. His descriptive cases help put flesh on the issues, and each chapter ends with a useful list of "practical considerations." Sev-

eral times, however, Drlica lapses into detailed scientific histories (for example, of Max Delbrück) that may seem confusing and tangential to his "consumer" audience.

No single guidebook is sufficient to lead us through the uncharted territory of genetics; indeed, there are no three guidebooks that will accomplish that. But the territory is vast and we are approaching it more rapidly than we know, so such books are valuable as we as a society decide where we will go and how we will deal with what we find when we get there.

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Industrial Geophysics

Science on the Run. Information Management and Industrial Geophysics at Schlumberger, 1920–1940. GEOFFREY C. BOWKER. MIT Press, Cambridge, MA, 1994. viii, 191 pp., illus. $27.50 or £23.50. ISBN 0-262-02367-9. Inside Technology.

At a time of growing interest in the development of so-called industrial science, this book examines the strategies by which one firm—specializing in the assessment of potential oil fields—developed proprietary techniques that were vital to its industry and rose to international prominence.

The Schlumberger firm was founded after World War I, at a time when theories of petroleum formation were not effectively predictive. Prospectors employed a range of surface and drilling techniques to discover and map oil fields, but scientific understanding lagged greatly behind technological exploitation and, embarrassingly, wildcat discoveries. Schlumberger used electrical logging to map oil fields by measuring subsurface resistivity. But, as Bowker notes, there is no simple measurement. Each oil field had its own peculiarities. Practicing what Bowker calls "science on the run," the firm, by imposing laboratory conditions in the field and maintaining close contact between field engineers and the calculators at its Paris headquarters, managed to weave generalizable knowledge from local data. Bowker focuses on the tightly controlled interpretation, manipulation, and dissemination of the information generated as key reasons for Schlumberger's success.

Schlumberger began with the major advantages of being a family-owned business with special access to the geophysically challenging Alsatian oil field of Pechelbronn. This rear base enabled brothers Conrad and Marcel Schlumberger to experiment with their techniques, train staff in relative secrecy, and watch competitors. Unstated but implied is that revenue from Pechelbronn supplied the deep pockets that kept the firm alive after some initial failures in the United States, the world's largest oil market, in the 1920s.

"Wherever the drill goes, Schlumberger goes." [From *Science on the Run*; Proselec]

Contingency—or luck—played a major role in Schlumberger's fortunes. Its unsuccessful North American ventures were in salt domes, where at the time seismic measurements were more predictive than electrical logging. Oil fields in the Caucasus and Venezuela, however, had the geophysical conditions necessary for electrical logging to succeed. A friendly Soviet government and the isolation of Venezuelan drilling sites further contributed to a more receptive business environment. While Schlumberger developed its logging techniques and expanded in those regions in the 1920s and '30s, potential competitors were removed as similar exploring firms were swallowed by vertically integrating oil firms in the United States.

When the company returned to the United States in the mid-1930s, it arrived with an international reputation, an array of well-developed techniques, and a tight organization for managing information. Not only was electrical logging now effective in a wide range of geological formations, it soon proved invaluable in the legal regulation of oil production in California and Texas. Following some adroit maneuvering in two crucial patent battles, Schlumberger established the leading international position it has maintained for over half a century.

Bowker looks at the firm's business strategy between 1920 and 1940; shows how it represented its work to different audiences to justify its activities, appear "scientific," and defeat competitors; and explores the internal infrastructure by which it established and maintained its position as an independent creator and broker of knowledge. The firm kept the specifics of its techniques secret while its engineers worked to generalize and adapt locally acquired information. For their money its clients received logs of electrical resistivity of their wells whose usefulness required interpretation by the Schlumberger engineers.

Key to Bowker's analysis is the assumption that Schlumberger's success depended on changing the way oil companies perceived the ground they drilled and how they drilled it. Local knowledge and control of the wells were insufficient; Schlumberger also had to negotiate and alter its corporate and political environments. Anyone working in biotechnology today will appreciate this situation and the skills it required.

Bowker's conclusion that innovations in work and organization—"locally controlling social and natural time and space"—preceded theory and the development of an industrial science fits well into the larger portrait being drawn by other studies in the field. His study demonstrates the importance of measurement and information management in the history of technology. Schlumberger succeeded in large part because of its ability to coopt both the natural and the social environments in which it operated.

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17th-Century Issues

The Scientific Revolution. STEVEN SHAPIN. University of Chicago Press, Chicago, 1996. xiv, 218 pp., illus. $19.95 or £15.95. ISBN 0-226-75020-5.

General accounts of the scientific revolution of the 17th century have been few and far between. Until the appearance of this