Justifications

At the Heart of the Bomb. The Dangerous Allure of Weapons Work. DEBRA ROSENTHAL. Addison-Wesley, Reading, MA, 1990. xii, 244 p. $18.95.

In the modern Western myth, scientists are imperfect gods. When they yield to hubris—when they mistake the goal of mastery over the natural world for an invitation to power—they fall heroically; hence Faust, Frankenstein, and, depending on whom you talk to, Oppenheimer. Now, at the waning of the Cold War, may be an opportune time to discard that myth. Edward Teller, perennial contender for Oppenheimer's statesman role, looks increasingly like a scientific Willy Loman. NASA's non-epic failures have taken much of the romance from the exploration of space. We are shocked by news of the cavalier disposal of waste from the nation's nuclear weapons plants. All of this is not to indict individual scientists but to call into question the contemporary institutional structure of science, particularly when it claims to operate in the service of public policy.

Debra Rosenthal has made an important, sensitive, and thoughtful contribution to this demythologizing project. In *At the Heart of the Bomb*, she explores the moral worlds of scientists and engineers working at the Los Alamos and Sandia National Laboratories. Los Alamos is one of two laboratories in the country charged with developing the guts or "physics packages" of nuclear weapons, and Sandia designs peripheral components and the final "delivery packages"—bombs, missiles, and torpedoes. This is an enterprise fraught with moral consequence, but Rosenthal's respondents appear as neither tragic heroes nor sci-fi villains. Rather, they are working people; like most of the rest of us, they are preoccupied with everyday concerns and show regrettably little capacity for moral insight and reflection.

This book has many strengths. Rosenthal, a political scientist, reports on over 260 hours of interviews, conducted in 1984–85, with 85 people who were currently or formerly employed by one of the two laboratories. This sample captures important variation in age, ethnicity, prestige, work history, and moral and political attitudes. She supplements her interviews with sensitive and detailed contextual observations on the history of the laboratories and of U.S. nuclear weapons policy, the culture of the wider Los Alamos community, and even the stunning—and, significantly, isolated—physical setting. Her central research question is, How do scientists justify their work on weapons that can potentially destroy the world?

If we expect our scientists to offer us profound answers to hard questions, we are disappointed by what Rosenthal reports. What we find instead is a closed moral universe—a company town—where issues of scientific responsibility are defined institutionally, hence rarely confronted by individuals. The scientists and engineers interviewed report almost never discussing the morality of their work with colleagues. When asked, they offer a range of responses: some claim to be fighting communism, and others attempt to minimize the proportion of their work spent on weapons. A few express a nerd-macho fascination with the unique technology at their disposal, from fast computers to nuclear shots; others frankly mention the lack of secure job opportunities in science. Several draw self-serving distinctions between nuclear research and research on chemical or biological weapons. Most, with some justification, attempt to spread the responsibility—to American politicians, to the public, and in one case to the man who delivers the mail to the laboratory gate. Rosenthal is evenhanded, treating laboratory critics as austerely as boosters. Her style is more ironic than polemical: she lets her interviewees speak for themselves, reporting details of personal style and setting in a deadpan way. And, as in any real-life conversation, what is unsaid is as important as what is said. Rosenthal's respondents become human in part through their contradictions, stutters, non sequiturs, and resonant ellipses.

This book is also disappointing in ways, especially to the social scientist's eye, because these data are almost entirely unanalyzed. By so reverently individuating her respondents, Rosenthal limits our ability to understand science—at least the weapons lab version—as an institution. The truly scary thing about these enterprises is not the moral failings of individual scientists but the tendency of the laboratories to cultivate technical innovations that will in turn generate new and more dangerous weapons programs. The incentive structure that produces these outcomes is a collective product, and one not unique to weapons labs. A more incisive and generalizable analysis would explore the effects of organizational and institutional dynamics on scientists' views of their work. Perhaps the most important, but least analyzed, theme in the book is the weapons scientists' frequently reported sense of stigma and alienation from mainstream academic science. Within the laboratories that alienation seems transformed into a sectarian ideology, but one that is interpreted differently by different groups of workers. There are hints in the text, for example, that older researchers use Cold War rhetoric to justify their research more often than their younger colleagues. Minority respondents seem to offer more pragmatic accounts than the overwhelming mass of white males. One wonders also whether accounts vary by professional status—do physicists and chemists talk differently from engineers, or Ph.D.'s from technical support staff?

Many academic scientists view applied laboratories, and weapons labs in particular, as parasites. And though it was clearly not her intent, Rosenthal's individualistic analysis allows us to infer that these weapons workers are a self-selected group of moral midgets. I suspect that both conclusions, though comforting in a way, are wrong. A more careful analysis of these interviews would have forced us to think about scientific morality as a product of organizational culture, and ultimately of the relationship between the state and the scientific profession as a whole.

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Cells into Organisms

Morphogenesis. The Cellular and Molecular Processes of Developmental Anatomy. JONATHAN BARD. Cambridge University Press, New York, 1990. xii, 303 pp., illus. $54.50. Developmental and Cell Biology Series.

This book is an excellent critical review of our current knowledge of the physical mechanisms by which organs and tissues are constructed during embryonic development. Bard carefully considers what we know (as well as what we don't know) concerning virtually the full range of morphogenetic events, from gastrulation to the formation of the cornea. Although he does presuppose some prior knowledge of embryology, the descriptions are unusually clear and should be sufficient to lead any interested reader quickly to the forefront of research on dozens of different topics. In