THE BIOLOGICAL REVOLUTION AND ITS CULTURAL CONTEXT

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In a recent article in *Commentary*,[1] American medical sociologist Florence Ruderman observes that the evolution of medical practice and medical attitudes in the United States has been guided largely by the autonomous development of biomedical science and technology. "Science," she asserts:

> . . . is a profoundly unsettling force . . . it causes endless dislocations and conflicts. Most basically, science is a source of independent values, motives, norms of conduct, and criteria of judgment. It sets its own course, defines its own goals. As for technology, *its* impact on medicine is even more obvious and direct; again, not just in producing tools or power but in transmitting values and in shaping the field from within. One need only think of the artificial-heart cases now in the news to realize that the physicians involved . . . are impelled by a technological drive that has its own logic and values, its own momentum—and its own dangers (24,45).

In an age in which developments in molecular biology, genetics, the biology of behavior, neurophysiology, and psychopharmacology seem to offer boundless medical payoffs, and, more importantly, seem to herald a Biological Revolution in how we think and live as decisive for our future as the Industrial Revolution has been for our past (3,12;5), there are many both inside and outside of science who would agree with Professor Ruderman. Yet the very example which she offers seriously undermines her thesis. Basic research in biomedical science and technology certainly may have made the development of an artificial heart possible, but no "technological drive" or autonomous scientific values have made its invention and utilization necessary and desirable.

To account for this reality, we must broaden our vision to include a whole range of influences: the economic interests of Humana, the American medical

An earlier version of this paper was presented at the 1984 annual meeting of the American Sociological Association.

conglomerate which has financed several such implantations largely for the sake of public relations; the "instant immortality" (7,188) which surgeons and researchers believe await those who are first to be successful in this area; the vast shortage of human donor hearts available for transplantation in the United States due to a residual religious sense of the inviolability of the human body even in death, and to the political impossibility in American society of requiring the routine harvesting of transplantable organs; the ritual celebration expressed in this procedure both of the sanctity of individual human life and of our mastery over nature—values central to American science, medicine, and culture; and finally the "disenchantment" of the body without which no artificial heart could be conceived, let alone implanted.

As the above suggests, and as others have persuasively argued (the recent efforts of Graham (9), Kass (13), and Lowrance (19) are particularly notable), the development and utilization of biomedical technologies, like all technologies, are subject to considerable economic, political, and cultural influence. But what of Ruderman's initial claim that the biological sciences are the source of new and "profoundly unsettling" values, norms of conduct, and criteria of judgment destined to reshape both the practice of medicine and the practice of living? Or is scientific knowledge, and the values and teachings articulated in its name, itself subject to cultural shaping? What I would like to suggest is that the development of a biological science and technology increasingly focused on man and his behavior has been guided decisively by the philosophical commitments and social assumptions of the scientists involved, commitments and assumptions which may strike an all too responsive chord in the minds of laymen.

Although sociologists and philosophers of science remain divided on the precise nature of the relationship between scientific knowledge and cultural values, many of our leading scientists, precisely in the most revolutionary areas of biology—molecular genetics and the biology of mind and behavior—have attempted to persuade the public of the radically new values, practices, and possibilities seemingly sanctioned by their scientific work. To French Nobelist Jacques Monod, writing in his *Chance and Necessity* (a bestseller in France second only to *Love Story*), the development of the molecular theory of the genetic code has proven conclusively that all organisms are simply the expression of their DNA "programs," which are themselves the product of "pure chance, absolutely free but blind" (20,112). The "scientifically warranted" (20,xiii) conclusion from this "fact" is the final destruction of the moral bases to our liberal Western societies—"a disgusting farrago of Judeo-Christian religiosity, . . . belief in the 'natural' rights of man, and utilitarian pragmatism" (20,171)—and the substitution of the survival and replication of DNA programs as our highest value.

To fellow Nobelist, geneticist Joshua Lederberg, we are no longer creatures of God or even "political animals," for molecular biology has shown instead that we are "six feet of a particular molecular sequence of carbon, hydrogen, oxygen, nitrogen and phosphorus atoms—the length of DNA tightly coiled in the nucleus of . . . [the] provenient egg and in the nucleus of every adult cell" (18,263–64). And in order to protect this genotype from the evils of humanitarian medicine, which preserves previously lethal genes, and of economic affluence, which decreases the fecundity of the socially successful, both genetic and developmental engineering must be practiced to ensure our own survival (18).

To the distinguished molecular biologist Francis Crick, scientific knowledge that "we are here because we have evolved from simple chemical compounds by a process of natural selection" utterly destroys the "Christian" and "literary" "nonsense" that has guided our lives for so long and that now interferes with the various prospects and possibilities opened up by science (4,89–99). For example, such Christian and humanistic "prejudices" as the belief in the sanctity of the individual or the rights of people to have children, still widely shared by a biologically ignorant public, stand in the way of the necessary and rigorous practice of eugenics (through mass sterilization, licensing of parents, or tax incentives) and the simple desire of scientists to try new things (e.g., breeding children with brains twice as large as normal) (33,274–77,364,380).

In the areas of biology more directly involved in the biology of behavior, similar assertions of the revolutionary implications of contemporary biology have been placed before the public. According to brain researcher José Delgado, thanks to our increased knowledge of brain functioning and behavioral control, "the human race is at an evolutionary turning point. We're close to having the power to construct our own mental functions . . . The question is what sort of humans would we like, ideally, to construct" (cited in Chorover [3,173]).

To entomologist Edward O. Wilson, the leading theorist of sociobiology (a new science which studies the biological basis of social behavior and organization in all species, including man), now that we know that man, like any other organism, is "only DNA's way of making more DNA" (31,3) and that mind and culture are simply "enabling devices," "engineered" and "programmed" by natural selection, the myths and moralities of traditional religions have been scientifically discredited, thereby exposing Western civilization to a dangerous "loss of moral consensus" and human purpose (32,2–4,195). But as Wilson argues in his classic text, *Sociobiology*, and in his Pulitzer Prize-winning *On Human Nature*, these same scientific advances and the genetic manipulations they make possible, enable us to produce a "biology of ethics": a new "enduring code of moral values" that will be "genetically accurate and hence completely fair" (31,575; 32,196–97). Such a biological ethic, with "the survival of human genes in the form of a common pool over generations" as its *summum bonum*, replacing salvation, justice, or even material well-being, will, however, compel us to reprogram our innate emotional guides and therefore, in effect to "decide how human we wish to remain" (32,6,196–97).

According to the biological anthropologist Robin Fox, now that we are in a position to know scientifically the true nature of human nature, that is, our "repertoire of evolved behaviour" and "the range of environments compatible with them," we can at last free ourselves of our "unnatural" aspirations, values, and moralities and "cut through a Gordian knot of 'civilised' behavior and industrial institutions," which are threatening us with species destruction. In its place we must restore a naturalistic ethic and a more natural society based on the primacy of survival and the new Golden Rule: "Always trust our essential human nature," including "its share of greed, jealousy, conflict, hate, killing, and exploitation" (8).

The values, criteria of judgment, and practical applications seemingly deduced by so many distinguished biologists from their scientific work are indeed "unsettling" both for the specific technological interventions they may sanction, and,

as Leon Kass has noted, because they "seem to force upon man a transformation . . . of his self-understanding and his view of his place in the whole" (13,3). Indeed, to judge by the remarkable popular success of so many of these works (and their publication by major trade presses) there appears to be a substantial lay audience willing to at least consider such a transformation. Yet, however persuasive and compelling such pronouncements may appear, they ultimately rest, not on unambiguous, logical inferences from objective, scientific facts, but on certain shared philosophical and cultural assumptions (for a more detailed account see Kaye [14]).

As has often been noted by historians of contemporary biology and by scientists themselves, the makers of the Biological Revolution have been motivated and guided by a perspective of mechanistic reductionism, not just in their public pronouncements, but in their scientific work as well (1,189,223; 6,11,226; 12,201–2; 26,17–33; 32,190–93,201–9). The systematic attempt to reduce biology to the laws of physics and chemistry; organism to program; behavior to genes; life to reproduction; mind to matter; and culture to biology represents far more than a research strategy; it expresses a fundamental and deeply held world view which precedes, rather than reflects scientific discoveries (14). As Francis Crick, for example, freely acknowledges, he was drawn from physics to biology less for scientific reasons than for the "religious" one of an atheist wanting "to try to show that areas apparently too mysterious to be explained by physics and chemistry (e.g., the borderline between the living and the non-living and the various phenomena associated with the "mind") could in fact be so explained" (cited in Olby [21,943]).

Thus when we read that an organism is simply a "realization of a programme prescribed by its heredity" (11,102) and "DNA's way of making more DNA" (31,3) and that therefore replication, genetic hygiene, and survival must take precedence over all other concerns, we are being presented with neither the compelling logic of objective fact, nor the gross illogic of a "naturalistic fallacy," but with the seemingly scientific expression of previously existing philosophical positions and value commitments.

However scientifically fruitful the mechanistic and reductionistic language of "codes," "blueprints," "programs," "factories," "devices," and "systems" have been and may well continue to be in the biological sciences, they are metaphysically laden and even scientifically limiting, as E. F. Keller's recent study of Nobelist Barbara McClintock, a geneticist with very different metaphysical views, has recently shown (15). Unfortunately, they may also prove to be socially harmful by encouraging the formulation of seemingly objective, yet politically and morally suspect solutions to what are essentially extra-scientific issues. If undesirable mental states and behaviors are "genetically programmed" then genetic "reprogramming" seems a sensible corrective; if "man is an animal," then, as Jacques Barzun notes, biological "needs" appear to take moral precedence over "self-mastery" and "higher purposes" (2,265–65,292); and if we are instead "survival machines" serving DNA molecules, then even our biological "needs" may require "retooling."

The drawing of such "scientifically" sanctioned implications were indeed given a kind of official recognition in the 1970 survey of the life sciences by the Committee on Science and Public Policy of the National Academy of Sciences,

published under the ambitious title *Biology and the Future of Man* (10).[2] In addition to demonstrating the dominance of reductionism in contemporary American biology, the study concludes by declaring as scientific fact, and advocating as social policy that: (1) what we call the "mind" and the "self" are merely epiphenomena of the brain, which itself is simply "one of the derived developed expressions of the genes"; (2) abortion, even for purposes of sex selection, is a legitimate means of producing a "happier society" by reducing the burdens placed on society by excess population growth and "nonproductive individuals"; (3) eugenics is necessary and acceptable as a means to "expand human potential" (10,889,908–9,916–17,927).

This reductionistic world view of contemporary biology has, in effect, been given legal status in the United States by the Supreme Court decision in the case of *Diamond, Commissioner of Patents and Trademarks v. Chakrabarty* (1980), which refuses to distinguish between animate and inanimate matter and thereby permits the patenting of engineered forms of life (13,143; 14,78).

However scientifically influential and socially significant this shared philosophical perspective may be, it is not the only cultural force at work in the Biological Revolution, nor can it alone account for the remarkable sense of urgency and moral passion with which so many prominent scientists have addressed the public, and for the equally remarkable receptiveness of that lay public. What historical and sociological analysts of contemporary biology have all too frequently overlooked is that the makers of the Biological Revolution are cultural revolutionaries as well (5;14). Filled with a sense of impending and even welcome social disaster, believing Western civilization to be teetering on the edge of destruction because of its cultural crimes against biological nature and its biologically false values and self-conception, these scientists argue that nothing less than a radical, biologically-guided transformation of our psyches and societies can save us.

For some biologists (e.g., H. J. Muller, Joshua Lederberg, and R. C. Edwards), the problem is essentially one of overpopulation and genetic deterioration for which modern medicine is largely to blame because of its subversion of natural selection; for others, biological retribution will take the form of ecological disaster born of our technological hubris and indifference to biological wisdom; for ethologists like Konrad Lorenz and his followers, apocalypse might well appear as nuclear annihilation, a symptom of our unnatural, industrial civilization's divergence from biological purposes, its suppression of biological needs and drives, and its creation of the tools and ideologies necessary for total destruction. But for others, including Crick, Monod, Wilson, Robert Sinsheimer, C. H. Waddington, and G. S. Stent, the crisis now threatening our species survival is more spiritual and moral than material: the scientific destruction of Western cultural beliefs and precepts—particularly those concerning human uniqueness and divine ordination—however necessary and desirable, has created a dangerous loss of meaning and social integration which biology alone can and must replace. According to Robert Sinsheimer, for example, "ours is a time of intense self-doubt, corroding confidence and crippling resolve," the result of the very triumphs of modern science. By mastering nature, science has made man's "own mortality, the brevity of his span and all its kinship, all the more senseless, frustrating and unbearable." With individual immortality and salvation of the religious sort sci-

entifically discredited, Sinsheimer proposes that survival and the conscious direction of human evolution towards a "higher state" through the practice of eugenics can conquer our current despair by providing us with our next self-transcendent goal (25).

The scenarios of doom may vary from scientist to scientist but "nearly all scientists concede the urgency of man's situation is so great that something must be done," as Nobelist and long-time president of the British Society for Social Responsibility in Science, M. H. F. Wilkins has noted (30). And that "something" characteristically involves the adoption of a new "bioethics" based on survival (see Potter [22]), the liberation of biological needs, and the obedience to biological purposes. Thus to the biocultural revolutionaries, it is now to what was once termed our "lower nature" and not to our "higher nature" that we are to look for guidance and salvation (14).

Yet this same apocalyptic sense of impending disaster, often tinged with hostility toward Western culture and the industrialized world, and this same belief in redemption through a return to the true path of biological wisdom and through a new "cult of survival" has emerged—*independent of biological discoveries*—as a prominent theme in American popular culture (for an analysis of apocalyptic and survivalist thinking in contemporary America, see Lasch [16;17]). For example, the various millenarian movements of the 1960s known as the counterculture were certainly obsessed with the notion of impending social collapse due to the excessive rationalization of Western life, and sought salvation through either personal or social survival strategies (e.g., natural foods and communes). The mid-1970s saw the rise of "The New Survivalists" in America who began to "head for the hills" with guns, grenades, and freeze-dried foods to await the welcome destruction of Western civilization by a nuclear, economic, or natural disaster, which would sweep the earth clean of "parasites and bureaucrats" and enable the surviving elect to found civilization anew. Even the contemporary nuclear disarmament movement, as expressed by Jonathan Schell, sees in its survival ethic not simply a means of preventing nuclear holocaust, but of overcoming human selfishness and social disintegration, thereby achieving a social, moral, and spiritual regeneration of man.

In popular literature, works such as Piers Paul Read's *Alive* (1974) and Terrence Des Pres's *The Survivor* (1976) which ostensibly provide objective accounts of various individuals in life-threatening situations (plane crashes, concentration camps), are instead celebrations of a new type of heroic individual, the "survivor." But whereas the heroes of the past successfully overcame creaturely necessities in the name of something higher, the survivor is one who has triumphed over the cultural and moral constraints upon the body's biological needs, constraints which threaten him with destruction.

In popular films too, the vision of a culturally-caused apocalypse and of salvation through a return to biological wisdom is central. As the critic Nick Roddick has shown (23), the enormously successful disaster movies of the 1970s (e.g., *The Poseidon Adventure* and *Towering Inferno*) share a common thematic pattern. A group of self-indulgent Westerners are suddenly faced with annihilation as some primal, natural force—earth, fire, air, or water—shatters their lavish, artificial environment, apparently as a punishment for technological and cultural hubris. In the struggle for existence that ensues the weak and morally repugnant are

eliminated while the physically and morally strong survive through the emergence of a well-integrated "natural" society, headed by a born leader whose qualities the corrupt, pre-disaster society had overlooked. The disaster is thus both retributive, for Western crimes against nature, and therapeutic in its liberation of that long-suppressed "nature" which makes survival and an harmonious social order possible.

Even in everyday American speech the word "survivor" is no longer limited to one who continues to exist after disaster, but has instead become a term of praise for those whose "innate talent for life" has enabled them to triumphantly overcome the moral squeamishness and social conventions which would inhibit their ability to "cope" in difficult situations. Thus, Patricia Hearst's fiancé presented her with a pendant bearing the inscription "Survivor 2-4-74" not to remind her of the terrible ordeal she had just lived through and the human "heart of darkness" therein revealed, but rather to symbolize the positive transformation of her own character, through her "survival experience" as an "urban guerrilla."

This parallel between the writings of prominent biological scientists and the survivalist themes in contemporary popular culture indicates, not the broad cultural impact of new scientific knowledge, but a shared perception of social disorder, individual meaninglessness, and political impotence. That the values, social policies, and technological applications discovered by biologists in their scientific work indeed reflects cultural and social influence is suggested by the striking case of embryologist C. H. Waddington.

As a prominent theorist and popularizer of evolutionary biology, Waddington was always reluctant to advocate the use of science as a guide to human affairs. In *The Ethical Animal* (1960), for example, he explicitly warns of the fallacies and dangers of "Social Darwinism"—the attempt to reduce cultural problems to biology and to use biological analogies as a source of social policy (28,206). Yet by 1969, Waddington felt compelled to organize a symposium to discuss how biology must now be used "to save the world" both by providing biotechnical solutions to all of our species-threatening problems, and, more importantly, by providing "a set of values . . . much more favorable for the solution of the grave social and psychological problems which mankind faces" (14;29,1,4–5,35–36). What happened during those nine years to make the dangers of biological analogies and of social Darwinism disappear was clearly not scientific breakthroughs, but what Waddington believed to be mounting evidence of Western political and cultural collapse, manifested particularly in the protests of the young.

But what makes this shared apocalyptic and survivalist mentality so significant is that it indicates the enormous potential appeal of these biological writings and of their potential biotechnical applications. If scientists and laymen really believe that we are nothing other than "survival machines," "designed" by natural selection and "programmed" by "selfish genes" to fulfill the "dream" of DNA to replicate itself (4;20;31;32), if we take as scientific truth rather than as reductionist fantasy that we can now "construct our own mental functions," choose "how human we wish to remain," "devise . . . a being new and finer" than *homo sapiens* (25), and manufacture the kind of beings we want, then what manipulations, what interventions, what forms of tinkering and feats of engineering will not appear possible and attractive? And if indeed we believe that disaster is near and survival is all, what scientifically sanctioned "solutions" will we not believe it to be nec-

essary to try? What legal constraints and "higher" concerns will not appear irrelevant? What form of spiritual, moral, and political triage will we not be prepared to accept?

The new biology, Leon Kass tells us, is deeply nihilistic, because in addition to creating a world of technological possibilities its "findings cause us also to doubt the truth and the ground of those standards [for human conduct] we have held" and which constitute "the very foundation of our ethics and the principles of our political way of life" (13,3–7). Yet it is not the "findings" of science themselves which are so corrosive, but rather what scientists and laymen *believe* about those "findings," beliefs that are philosophically rooted and culturally shaped.

NOTES

[1] *Commentary* is the leading journal of Neoconservative opinion in America.

[2] The National Academy of Sciences is the official adviser to the United States Government on matters of science and technology.

REFERENCES

1. Allen, G. *Life science in the twentieth century*. New York: Wiley, 1975.
2. Barzun, J. *Science: The glorious entertainment*. New York: Harper and Row, 1964.
3. Chorover, S. L. *From genesis to genocide*. Cambridge, MA: M.I.T. Press, 1979.
4. Crick, F. *Of molecules and men*. Seattle: University of Washington Press, 1966.
5. Fleming, D. On living in a biological revolution. *Atlantic*, 1969, 223, 64–70.
6. Fleming, D. Emigré physicists and the biological revolution. In D. Fleming & B. Bailyn (eds.), *The intellectual migration: Europe and America 1930–1960*. Cambridge, MA: Harvard University Press, 1969, 152–89.
7. Fox, R. C. *The courage to fail*. Chicago: University of Chicago Press, 1974.
8. Fox, R. Of inhuman nature and unnatural rights. *Encounter*, April 1982, 47–53.
9. Graham, L. R. *Between science and values*. New York: Columbia University Press, 1981.
10. Handler, P. (ed.) *Biology and the future of man*. New York: Oxford University Press, 1970.
11. Jacob, F. *The logic of life: a history of heredity*. New York: Pantheon Books, 1973.
12. Judson, H. F. *The eighth day of creation*. New York: Simon and Schuster, 1979.
13. Kass, L. R. *Toward a more natural science: Biology and human affairs*. New York: Free Press, 1985.
14. Kaye, H. L. *The social meaning of modern biology*. New Haven, CT: Yale University Press, 1986.
15. Keller, E. F. *A feeling for the organism*. New York: W. H. Freeman, 1983.
16. Lasch, C. *The culture of narcissism*. New York: W. W. Norton, 1978.
17. Lasch, C. *The minimal self: Psychic survival in troubled times*. New York: W. W. Norton, 1984.
18. Lederberg, J. Biological future of man. In G. Wolstenholme (ed.), *Man and his future*. Boston: Little, Brown, 1963, 263–73.
19. Lowrance, W. W. *Modern science and human values*. New York: Oxford University Press, 1985.
20. Monod, J. *Chance and necessity*. New York: Knopf, 1971.
21. Olby, R. Francis Crick, DNA, and the central Dogma. *Daedalus*, 1970, 99, 938–87.
22. Potter, V. R. *Bioethics: Bridge to the future*. Englewood Cliffs, N.J.: Prentice-Hall, 1971.
23. Roddick, N. Disaster movies: Only the stars survive. *Times Literary Supplement*, 14 March 1980, 297–300.

24. Ruderman, F. A. A misdiagnosis of American medicine. *Commentary*, January 1986, 43–49.
25. Sinsheimer, R. L. Prospects for future scientific developments: Ambush or opportunity. In B. Hilton, D. Callahan, et al. (eds.), *Ethical issues in human genetics*. New York: Plenum Press, 1973, 341–51.
26. Stent, G. S. *The coming of the golden age*. Garden City, N.Y.: Natural History Press, 1969.
27. Stent, G. S. *Paradoxes of progress*. San Francisco: W. H. Freeman, 1978.
28. Waddington, C. H. *The ethical animal*. London: Allen & Unwin, 1960.
29. Waddington, C. H., ed. *Biology and the history of the future*. Edinburgh: University of Edinburgh Press, 1972.
30. Wilkins, M. H. F. Introduction. In W. Fuller (ed.), *The biological revolution: Social good or social evil?* Garden City, N.Y.: Doubleday, 1972, 3–10.
31. Wilson, E. O. *Sociobiology: The new synthesis*. Cambridge, MA: Harvard University Press, 1975.
32. Wilson, E. O. *On human nature*. Cambridge, MA: Harvard University Press, 1978.
33. Wolstenholme, G., ed. *Man and his future*. Boston: Little, Brown, 1963.