

helped to take their first steps, perhaps, towards a science that is in need of radical renewal” (p. vii).

The rest of the book is thereafter divided into two more or less equal parts of almost exactly the same number of pages. Part I in twelve chapters sets out with detailed argumentation and documentation the pseudo-scientific nature of vivisection and animal experimentation in general. He supports his negative critique by drawing detailed attention to several cases in point such as the pseudo-scientific nature of most cancer research, birth defects due to thalidomide and the vivisection approach to surgical training. Part II presents the positive critique, namely by setting out some proven and promising methodological alternatives to vivisection such as, among others, the epidemiological method, computer simulation and *in vitro* techniques.

With respect to his negative critique, we may briefly outline here three of his cases in point, namely, cancer, thalidomide and surgical training. In the case of cancer, Professor Croce points out that “All vertebrates are susceptible to cancer,” and so they can be used as “natural experimental models” by meticulous observation of how the disease develops in them spontaneously in the natural environment (p. 33). However, since that method is too slow and impractical due to the large number of animals (dogs, cats, mice or rabbits) that need to be involved, researchers create artificial models by “inoculating the chosen animal with cancer or causing the disease by various other means, chemical or physical” (p. 33). Needless to say, that is not how human beings normally catch cancer, so where is the analogical causal relevance?

However, a more serious problem lies in the fact that “The same cancer-causing substance gives different results, not only from species to species, but also from one strain to another of the same species” (p. 33). For example, chloroform causes liver cancer in female but not male mice; and though benzol and arsenic are carcinogenic in humans, they “are not so in any of the rodent species commonly used in experimental laboratories” (p. 34). This flawed science has resulted, for instance, in the drug diethylstilboestrol or stilboestrol, a synthetic oestrogen for checking cancer of the prostate and preventing miscarriages but was found to cause transplacental cancer twenty years after the drug was first marketed (pp. 33-34).

A more infamous example is the drug thalidomide which was widely and aggressively marketed in the fifties and sixties as “a harmless tranquillizer particularly suitable for the pregnant woman” since it has been shown to be not teratogenic “after repeated and rigorous animal tests (p. 43).” But again unfortunately, what is not teratogenic (i.e., inducing malformations in the

embryo) for animals may not necessarily be the case for humans, and the result were the thousands of malformed babies born to women who took the drug during pregnancy. As for surgical training, Professor Croce argues that “if anatomical variations in humans form one of the most insidious pitfalls for the surgeons, even for the most expert, is it superfluous to add that such anatomical variations *cannot be learned on from animals?*” (p. 65). He prefers more trustworthy alternatives such as training in pathological anatomy,⁶ learning from experienced surgeons, three-dimensional computer imaging and teaching by means of computer assisted audio-visual methods which “put us in direct contact, so to speak, with the operating theatres of the greatest surgeons as they are in the very act of operating directly on humans....” (p. 67).

Okay, but what are the “basic methods of biomedical research” (p. vii) to replace vivisection? This question is tackled in detail in the second part of the book, and it turns out that alternatives have been there all along, but most researchers have opted to remain stuck in the vivisectionist mode of thought due to intellectual inertia and cognitive complacency. For Professor Croce, these alternatives are the truly scientific methods of biomedical research as opposed to the pseudo-science of vivisection. Medical science is about preserving human health and that requires observing humans, not animals, for “human beings themselves and their habits offered reliable experimental models” (p. 113).

For instance, epidemiology studies directly the way diseases like cancer, cholera, etc., actually occur in real human populations and obtains important, fundamental results otherwise unobtainable by “whole armies” of vivisectionists “conducting absurd studies on animals” (p. 113). The nowadays well known risk factors for heart disease in humans such as smoking, excess animal fat in the diet, lack of physical exercise, obesity and high blood pressure were identified by means of epidemiological studies done in the sixties and not by inducing heart attacks in lab-animals (p.113). Another scientific method highlighted is computer simulation since the computers’ “mnemonic ability” preempts “useless repetition of research” and facilitates their use as “experimental models” by feeding them with all

6. Muslims may find this method problematic from the *fiqh* point of view, but we’ll not go into *fiqh* issues here.

“confirmed information” relevant to, say, human respiration. As a “theoretical breathing apparatus,” the computer will simulate, i.e., calculate, “the results of the variations to which one or more of the systems comprising respiration may be subjected.” But do not expect reliable answers from computers overfed with data about rabbit respiration (p. 131).

Another promising scientific alternative discussed in some technical detail is *in vitro* techniques, including various aspects of cell and tissue culture, together with a critical overview of their advantages for medical research, but here is not the place discuss them in any intelligible detail. As the book is read with scientific fascination and moral concern, one is brought to the shocking realization that vivisection was and is perpetuated precisely because it was a convenient way to get research fellowships and maintain academic positions under the guise of respectable scientific research. Since it lacks any scientific basis, the only justification for it is commercial but modern civilized laws in the public interest are not fine-tuned enough to prevent the invasion and corruption of the medical fraternity by big business.

All truly humane and truly scientific methods of medical research to replace the intolerable cruelty of pseudo-scientific vivisection are certainly in accord with the philosophy of medicine in Islam (as outlined, for instance, by Professor Osman Bakar in his book *Tawhid and Science*⁷), and hence, Muslim medical, biomedical and biotechnological students, teachers and researchers should find a wealth of creative and innovative theoretical and methodological insight in this regard from this valuable book. Not only Muslims, but also all those who believe that life is more, much more, than a conglomeration of cells, tissues and organs, will find this book indispensable.



7. Republished as *The History and Philosophy of Islamic Science* (Cambridge: Islamic Texts Society, 1998).

Brian Tokar (ed.), *Redesigning Life? The Worldwide Challenge to Genetic Engineering* (London and New York: Zed Books, 2001), 440 pp, Pb, index, ISBN 1 85649 835 2

This book documents in one handy volume the global negative effects of the present-day overly-commercialized model of biotechnology/ genetic engineering (BT/GE) research on health, food security and indigenous economies. It even calls into question the scientific integrity of the overly optimistic claims of BT/GE to enhancing food production and overcoming diseases.

While not actually advocating a wholesale abandonment of the BT/GE program, the book does emphasize that it is high time for scientists in the public interest to take a thorough second look at BT/GE and do a systemic review of all its theoretical assumptions and research methods. Political economists in the public interest may also do well to deconstruct the not-so-altruistic socio-economic objectives which drive much of BT/GE research today.

The book is divided into four parts of a total of thirty-one articles by various authors, including such notables as Vandana Shiva, Tokar himself, Beth Burrows, David King, Hope Shand and Victoria Tauli-Corpuz. Part one has eight chapters centering on the theme of health, food and environment. The six articles of part two focus on “medical genetics, science and human rights.” The next part of eight articles deals with the issue of “patents, corporate power and the theft of knowledge and resources.” While these first three parts are concerned with the various shortcomings and negative impacts of BT/GE, the last part tells us through eight articles just what the free peoples of the world are doing about the GE threat to their sense of biological and spiritual well-being.

The substantial seventeen-page Introduction by the editor ably overviews the contents of the book. For Tokar, BT/GE encapsulates the intellectual conceit and political economic tyranny of a technology gone way off-track. It is a science that has to be done simply because it can be done and society at large will just have to adjust its values to its absolute utilitarian ethos. It symbolizes, or rather, it constitutes “the rise of a new technological and financial elite who act as if the earth and all its inhabitants are little more than chess pieces that can be endlessly played and manipulated to satisfy the insatiable wants of an extravagantly wealthy few” (p. 2). In sum, it is technology for money as an end in itself; an end to end all ends, nay, all life, if need be.

In order to ameliorate popular misgivings about the safety of BT/GE, science students and teachers (who are often not much wiser) are hoodwinked by the biotechnology industry into believing “that genetic engineering is not essentially different from traditional, time-tested interventions such as the breeding of plants and animals, or using yeasts to make bread or beer” (p. 4). However, this suggestion of “a continuum from cultivating wheat to cloning sheep is a gross misrepresentation of both history and biology” (p. 5). While breeding is restricted to genetic exchange between animals and plants that mate naturally, gene splicing transcends this natural restriction to facilitate genetic exchange between totally unrelated organisms, hence creating and introducing new types of organisms into ecosystems which have never known them.

Apart from the unforeseeable impact of novel GE organisms on the natural environment, the book also highlights socio-ethical concerns pertaining to farmers’ rights over their crops and seeds, patenting (a.k.a. monopolizing) of genetic information, genetic reductionism in medicine and the insidious revival of eugenics in gene therapy. For Tokar, BT/GE epitomes a science driven by greed, i.e., the commercial lust to reduce all life “to a set of objects and codes to be bought, sold and patented” (p. 7).

In the century-long tradition of sustained and often brilliant counter-attacks against the rise and dominance of global “technopoly,”⁸ this book should find a prominent place amongst the works of such conscientious writers as Theodore Roszak, Jerry Mander, Ivan Illich, Vandana Shiva, Claude Alvares, Martin Khor, Ashis Nandy, Pietro Croce, Majid Rahnema, Neil Postman and last but probably foremost, Paul Feyerabend.

As one who graduated from the very center of global “technopoly” (MIT), Brian Tokar is well positioned as an insider critic of a technology that would disfigure, even destroy, life itself, simply because it can be done, and moreover, be done for money, the one true god.

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8. Postman, Neil, *Technopoly: The Surrender of Culture to Technology* (New York: Vintage Books, 1993).