Ramifications of Genetics

In the Name of Eugenics. Genetics and the Uses of Human Heredity. DANIEL J. KEVLES. Knopf, New York, 1985. x, 426 pp. $22.95.

All acts of human reproduction have genetic consequences. Do they also have eugenic consequences? If we define the term "eugenics" as representing conscious attempts to change the genetic composition of a population, they do not. If we define eugenics in terms of consequences and not intentions, they may. The term thus takes on a double meaning; one being descriptive, objective, and almost synonymous with natural selection and the other being troublesome and controversial, as are all willful interventions in biological processes that are meant to bring about changes in the human condition. Eugenics in this latter sense has usually been mischievous, promoting social movements that led to legislation embodying compulsory sterilization, restriction of immigration, and racism in the United States. In the hands of German National Socialism, the racist policies championed by Hitler so tarnished the term eugenics that to this day it arouses alarm.

Kevles begins his study of eugenics with Francis Galton, who first introduced the term in 1883, about 15 years after he conceived the idea in both its intentional and its consequential form. Kevles early on lets the reader know his feelings: "Since Galton's day, 'eugenics' has become a word of ugly connotations—and deservedly," and he sees eugenics as still alive "in the claims of those arguing for a racial basis of intelligence, in certain tenets of sociobiology, and in some prospects for human genetic engineering."

Kevles's inquiry has three objectives: he provides a history of eugenics, a history of human and (to a lesser degree) medical genetics, and an appraisal of past, present, and possible future misuses of eugenics. The first objective is pursued through a comparative approach in which the development of the American and British schools is traced, especially after the rediscovery of Mendelism in 1900. There is some analysis of eugenics in Germany, especially after Hitler's rise to power, but no attempt to survey the worldwide influence of eugenics in the first third of this century, which even captivated some biologists in the Soviet Union. Kevles does not pursue the tension between research geneticists like Morgan, Wilson, Shull, Castle, and Emerson, who usually ignored or personally disliked eugenics as an applied social philosophy, and advocates of differential reproduction like Davenport, Laughlin, Popenoe, and Gosney. In this respect, Kenneth Ludmerer's *Genetics and American Society* provides a broader picture of the debate going on. Among those not familiar with the participants in these debates, there is an impression that eugenics was a creation of geneticists with a politically conservative outlook. Yet eugenicists included some eminent leftist geneticists such as Muller, Huxley, Hogben, and Haldane. Kevles acknowledges their repudiation of what he calls mainline eugenics, the elitist and often racist outlook of the privileged classes. He assigns most of their interest to the appeal of positive eugenics, especially the increase in the number of individuals with higher intelligence.

Kevles stresses the antagonism between Bateson's school and Pearson's over Mendelism, a scientific brawl that kept Bateson out of the eugenics movement because Pearson had fully embraced the views of his mentor, Galton. Kevles's analysis of the British interest in eugenics is thorough and provides insights missed by scholars in the history of eugenics. Galton idealistically sought to improve humanity by encouraging the most talented to have larger families. The American movement, as Kevles points out, stressed a judicious pruning of supposedly inferior strains. Kevles's study of the American movement would have been enriched had he followed the growing interest in differential reproduction in the last two decades of the 19th century (that is, before the rediscovery of Mendelism) and had he pointed out how few of the major contributors to basic genetics were active in promoting it. The American eugenics movement was so tainted with racism, spurious elitism, and popular prejudice that it was denounced vociferously in 1932 by Muller in his address "The Dominance of Economics over Eugenics" at the Third International Congress of Eugenics held in New York City. Although Kevles cites it (pp. 122 and 179), he does not stress the international importance of this address, which was widely quoted in newspapers in the United States and abroad and reprinted in several languages.

Kevles is at his best in describing the rise of the Penrose school and revealing the antipathy Penrose had for eugenics. Penrose effectively purged eugenics from Galton's original endowed chair, which he held after Fisher left, and he played a major role in shaping the early history of human genetics. Kevles's description of the tension between Fisher and Penrose, who respected each other's quantitative approaches to human genetics, is helpful because it avoids the tendency to reduce conflicts to a matter of sharply bounded camps.

Kevles's treatment of human and medical genetics is uneven. The account of cytogenetics begins with the introduction of successful karyotyping techniques by Tjio and Levan (1956), although there is a rich history that preceded that development. The account of biochemical genetics is limited to a few examples, including the successful interpretation of phenylketonuric idiocy by Fölling and the analysis of the hemoglobinopathies by Pauling and Ingram. Since many of the cytogenetic discoveries mentioned by Kevles were worked out after 1960, as were, concurrently, the metabolic and molecular bases of numerous inherited disorders, the reader is left with a sketchy picture of human and medical genetics. The shift from human genetics to medical genetics took place in the 1960's, and it revolutionized research in academic medicine and opened up profound debate in society on the consequences of using (or not using) the medical technologies and insights emerging from that rapidly developing field.

This last aspect is explored by Kevles in his final three chapters dealing with the new eugenics, the IQ controversy, and genetic engineering. Kevles attributes much of the interest in the new eugenics to Muller's concept of genetic load. Muller's concern about the accumulation of spontaneous mutation in human populations and his belief that an equivalent amount of mutation is no longer being eliminated through natural selection led him to return to Galton's idealism of differential reproduction, this time using the technology of artificial insemination and the inferred safeguard of germinal choice. Virtually no geneticists have endorsed Muller's views, largely, I believe, because the trauma of past abuses of eugenics eclipses any prospect that a nation, be it socialist or capitalist, would be free of its assorted prejudices. At the same time few geneticists and none of the critics of eugenics have addressed the issue Muller raised. If the genetic load will increase to our detriment under the conditions of modern civilization, what should our response be?

The IQ controversy is a much-evaluated and sorry part of the old American eugenics movement. It includes Terman's prospective studies of gifted children in California begun in the 1920's and, much more significantly, the Army alpha tests administered to

inductees throughout World War I. Kevles gives a detailed history of the mischievous ways the Army alpha test was used, but he does not cite the Galtonian views adopted by Terman. Jensen's revival of the IQ debate in 1967 and Herrnstein's tenuous interpretation of U.S. society as a genetically based meritocracy are flawed in the same way as the earlier studies. The arguments for major genetic components for intelligence are based on analogies to quantitative inheritance in plants with no new evidence identifying the inferred participating individual genes or their functions.

I would disagree most with Kevles's worries about the new genetics and medicine. Few physicians enter medical genetics today to reduce the number of defective genes in the population; they do so to treat the sick and to salvage the defective. Recombinant DNA technology is intended to be only one more medical tool, helping patients to function more normally. Will this medical revolution have genetic consequences? Of course it will; so has the use of antibiotics for bacterial infections, the chlorination of water supplies, mass inoculation against infectious diseases, or the use of blood transfusions. None of these programs was intended as a eugenic measure.

Similarly, parents rarely elect prenatal diagnosis and abortion because of their concern for the gene pool. They do so because they fear raising a severely impaired child and do not wish to take on the financial, psychological, and medical burdens that would involve. It is not a prejudice against the genotype of the handicapped child that the parents display, it is a rejection of what fate has dealt them. Whatever the merits of the choice involved, they are rarely based on eugenic considerations.

Kevles's survey of eugenics, despite my criticisms, illustrates well the shallow values, the cultural biases, and the private fantasies that motivate many of its ardent supporters. Perhaps the most important lesson for the idealistic geneticist who hopes to elevate humanity to direct our own evolution is to reflect on the repeated vulgarization of complex genetic studies, reduced to simplistic models of human health and behavior, by those with more fervor than professional competence. It may take many generations for us to compensate for the genetic consequences of our present breeding habits, but it would be folly, considering today's standards of cultural prejudices, to intentionally modify those habits as public policy in the name of eugenics.

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A Transmutation in Physics

From Maxwell to Microphysics. Aspects of Electromagnetic Theory in the Last Quarter of the Nineteenth Century. JED Z. BUCHWALD. University of Chicago Press, Chicago, 1985. xvi, 339 pp., illus. $70.

It was during the period roughly from 1875 to 1900 that the approach to electromagnetic phenomena enunciated by James Clerk Maxwell in his *Treatise on Electricity and Magnetism* of 1873 was transmuted into modern classical (nonquantum) field theory. Though the historical comments in physics textbooks often seem to suggest that classical electromagnetic field theory sprang fully developed from Maxwell's own writings, those who have taken more than a passing interest in the history of electromagnetic theory have long known that the story is more complex. In brief, rival approaches to electromagnetic theory coexisted through most of the 19th century: in Britain, the field theory tradition dominated, stemming from the work of Michael Faraday and further developed most significantly by William Thomson and Maxwell; on the Continent, the action-at-a-distance tradition prevailed, as represented most trenchantly in the work of André Marie Ampère, Franz Neumann, and Wilhelm Weber. Modern field theory resulted from a union of the two traditions, in which the field emphasis of the British approach was melded with the emphasis on electrical particles of the Continental approach to yield classical field theory, which regards both electromagnetic fields and charged particles as fundamental. *From Maxwell to Microphysics* deals with the final elaboration of the British tradition and its subsequent union with the Continental tradition.

Buchwald's detailed and perceptive study of the final, "Maxwellian" period in British field theory—beginning with Maxwell himself, extending through the work of the British Maxwellians such as J. J. Thomson, George Fitzgerald, and Joseph Larmor, and including also the more experimentally oriented work of the Americans Henry Rowland and Edwin Hall—establishes more clearly and concretely than ever before the extent to which, and the way in which, the Maxwellian theory of the later 19th century differed from modern electromagnetic theory. Two related themes are central in this connection. First, Maxwell and the Maxwellians—in this directly and faithfully carrying on the tradition of Faraday—were committed to the primacy of the field: rather than viewing charges and currents as the sources or causes of the field, as in modern electromagnetic theory, they viewed them as epiphenomena, emergent consequences of field dynamics. Second, and relatedly, they regarded electromagnetic phenomena as manifestations of an ethereal continuum, which was to be described in terms of continuous, macroscopic variables and whose interactions with ordinary matter were to be treated macroscopically as well, rather than microscopically as in modern electron theory. Though the issue of the primacy of the field is perhaps the more important in the broader 19th-century context, the question of macroscopic versus microscopic description is the more significant for Buchwald's part of the story: He discusses the Hall effect and magneto-optics as central examples of the Maxwellian approach, in which what are modernly regarded as manifestations of the microphysics of electrons were treated by the Maxwellians entirely in macroscopic terms.

The other part of the book is concerned with the decline of the Maxwellian approach and the transition to modern field theory. Emphasizing again the macroscopic-microscopic distinction, Buchwald presents this episode not as a simple melding of British and Continental approaches but rather as a two-step process, in which the British and Continental communities acted together to a substantial extent: Initially, there was a broad acceptance of the Maxwellian, macroscopic approach; Heinrich Hertz's macroscopic treatment of moving media is a good example of Continental participation in this. Thereafter, there was an internal collapse of this approach owing to technical failure (especially in connection with magneto-optics), followed by the transition to a microphysical approach; Larmor's electron theory is a good example of British participation in this phase. In this way—by giving particular attention to the macroscopic-microscopic issue—Buchwald gains a novel perspective, which greatly enriches our understanding of this period.

Buchwald's text is heavily mathematical, which turns out to be a mixed blessing. On the one hand, the perceptive renderings of the mathematical arguments associated with the various theories provide a level of concreteness and verisimilitude that is both salutary and unusual—too much of contemporary history of physics represents a flight from the mathematical rigor that the history of mathematical physics demands. On the other hand, the sheer weight of mathematical symbolism sometimes makes it difficult to see the forest for the trees, and one wishes—at least the present reader, in his weakness, does—that the mathematics had been edited down in places. Buchwald makes use of a reasonably uniform mnemonic vector notation, rather than the original variety of symbols—component, quaterni-