gists with their subject matter was manifested during a symposium on population dynamics that focused heavily on Scottish seals and salmon. Students of salmon biology tended to neat tweeds, conservative politics, and pipe smoking whereas students of seals were kilted, bearded, and reddish. Out of intellect and passion there has developed a British, and generally Old World, tradition of painstaking, long-term, field investigation, which, though it may not have high prestige among the hot sciences of the universities, has enormous value.

At a deeper level, ecology is intractable in contrast with, say, traditional branches of physics, the epitome of intellectual tractability. Physics is free to decide what is or is not within its own domain. Meteorology and most nonlinear hydrodynamics were banished as non-physics for most of this century and permitted in only when a promising theoretical methodology became available. Sciences whose domains are defined by their capacities are tractable in a way that is impossible for sciences defined by a domain of subject matter. Ecology, geology, medicine, and other intractable sciences must wrestle with a preassigned subject matter as best they can, often by focusing on expensive test cases. But their subjects are ones of enormous importance. Major advances in intractable sciences can only be expected from new technologies, adequate funding, and intelligent administration, with constant reexamination of current state and pattern of progress. We cannot rely on rigid administration, proclamations, low funding, and the hope that somehow the problems will solve themselves.

We know that current applied ecology is mired in litigation and suffers a shortage of relevant data, at every scale from local water supplies to global wood supplies. We are not doing the obvious things that need doing. We know, for example, that satellites can provide ecologically important observations if their eyes are turned toward Earth and the resultant data are made generally available. This ought to be considered while NASA gropes for a post-shuttle mission. We know that ecotoxicology requires doing and isn't being done; and so on. Certainly scientific societies ought to be facing these various problems, and perhaps this volume can provide suggestions of how scientific societies can and cannot function. We must show better progress in the next 75 years, lest the problem becomes moot in the 75 years after that.

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Uses of Biology

Racial Hygiene. Medicine under the Nazis. ROBERT PROCTOR. Harvard University Press, Cambridge, MA, 1988. xii, 414 pp., illus. $34.95.

Since the Nazi period there have been a variety of books concerned with the so-called "roots," or at least background, of National Socialism. Proctor's intensively researched work is the most thoroughgoing yet with regard to the so-called scientific background of a movement that often declared itself to be "scientific" in the application of what it liked to call the "laws of life" to human affairs. It is a deeply disturbing book, concerned as it is with how fine scientific minds, many of which were at least formally committed to the practice of healing, not only "sold themselves to the devil" but, through their own theoretical musings and prejudice-tinctured social concerns, anticipated his arrival. It is an at times passionate exegesis on how "value-free" science is a disingenuous contradiction in terms and, more important, on how people who believe in so chimerical an enterprise could and can contribute to social pathology.

Proctor does not view the emergence of "racial hygiene" as an aberration. Indeed, one of the most valuable aspects of his work is his placement of this notion within the context of Western scientific traditions, the most important of which was that concerned with racial betterment. Here, Proctor points out that eugenics, not necessarily racist in nature or application, was a crucial concern not only of individuals who could be identified as "right-wing" in nature but of a panoply of left-wing or "progressive" thinkers as well as social reformers, including, among others, Margaret Sanger. Indeed, during the early years of the 20th century, individuals such as Alfred Ploetz, Wilhelm Schallmayer, and Ludwig Woltmann, who would later be seen as groundbreakers for the application of the Nazi scientific vision to human affairs, were "cautious advocates of certain forms of progressive social reform" (pp. 21–22). The application of presumably well-established biological laws (in part resulting from the overthrow of Lamarckian hypotheses by genetics) to social issues was part of the ideational environmental of Western civilization. Eugenics, and radical articulations of it such as forced sterilization of "defective" or "criminal" types, had found legal expres-

J. F. Lehmanns Verlag / München 1930

J. F. Lehmanns Verlag / München 1936

"Official cartouche of the Julius Friedrich Lehmann publishing house, before 1933 (above) and after 1933 (below). Lehmann was one of the largest medical publishers in the first half of the twentieth century as well as the single largest German publisher of works in the field of racial hygiene. The motto below the lion reads: 'I Have Dared.' " [From *Racial Hygiene*]

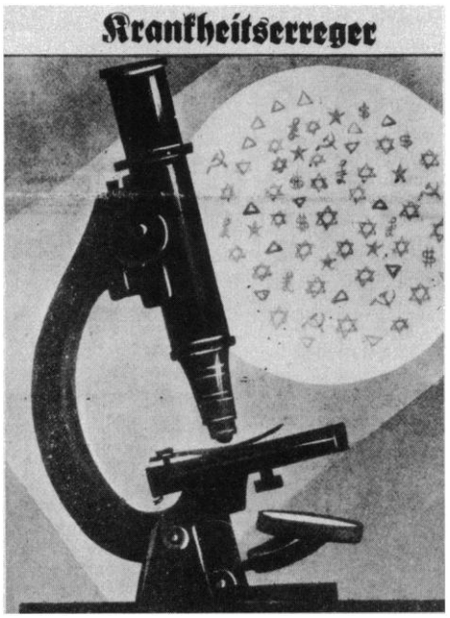
sion, most notably in the United States, where, in 1907, Indiana led the way. Indeed, as Proctor points out, the American experience became something of a model for a host of German biological scientists and physicians concerned with racial improvement.

The turning point, so far as the National Socialist connection was concerned, was the forging of links between putatively racially neutral eugenics and Nordic supremacy movements. Though, as Proctor points out, there always had been some "overlap" between the two, it was from World War I on—mainly in Germany but elsewhere as well—that racial hygiene and Nordic (or Aryan) supremacy came together. With Nazism's coming to power, ambivalences and uncertainties were dissolved in the solvent of ideological enthusiasm, and Ploetz, Fritz, Lenz, Julius Friedrich Lehmann, and Woltmann found themselves hailed as prophets of a new order. Lesser-known German biologists and physicians, both inside and outside the National Socialist movement, translated presumably established "laws of life" into concrete policies concerned with the role of women, family planning, the burdens imposed on society by "lives not worth living," and threats presented by races perceived as inferior but dangerous.

Obviously, Proctor has taken issue with the notion that Nazism was self-consciously irrational or anti-intellectual. As he sees it, its most nightmarish qualities were provided by scientific minds and scientific rationalizations free of emotion, much less empathetic understanding. In the end, however, value-free, apolitical scientism, devoid of critical self-reflection, simply allowed the prejudices and unquestioned assumptions of a particular time and a particular place to be articulated in the "objective" idiom of scientific certainty. The lessons for our own age are baldly obvious.

It is thus especially distressing that this fine work has defects. Some of these are the usual minor ones. Various phrases in German are left untranslated, others that need not be translated are, at least one inaccurately (SA did not stand for "storm troopers"; "storm section" would be more accurate). At times unnecessary attention is focused upon rather well-known political events, the work is sometimes repetitive, and all in all the editing is not of a quality that one expects of the Harvard University Press. More important, though, are occasional errors of fact. On p. 165, for example, we are introduced to the "Nazi classic" *Rembrandt als Erzieher* (*Rembrandt as Educator* is the translation that should have been provided). We are told in a footnote that this piece, in fact first published in 1890, was written "in the early years of the twentieth century" and learn that it was not a "Nazi" work at all, even though the movement certainly approved both of it and, to some extent, of the author, Julius Langbehn, who is never mentioned. On p. 142, Proctor tells us that the German Anti-Semitic Party continued to grow in strength up to World War I. Actually, in terms of percentage of the vote, it peaked in the 1890s and, as several authors have pointed out, was in *decline* by World War I.

" 'On the Cutting Edge of Racial Thinking.' Racial hygienists at work in the archives of the Institute for Human Genetics and Racial Policy in Jena. The Jena Institute, directed by Rector Karl Astel, was one of Germany's thirty-odd institutes for racial science and racial care." [From *Racial Hygiene*; *Das Schwarze Korps*, July 1937, p. 3]



" 'Infectious Germs.' Under the microscope are symbols for Jews, communists, and homosexuals (triangles), alongside the British pound and the American dollar." [From *Racial Hygiene*; *Der Stürmer*, 15 April 1943, p. 1]

Proctor also overlooks a number of relevant secondary works. In the opinion of this reviewer, he underestimates the role of Ernst Haeckel and his Monist League, and consideration of Daniel Gasman's *The Scientific Origins of National Socialism* (1971) might have been useful in this regard. Nancy Stepan's *The Idea of Race in Science, Great Britain, 1800-1960* (1982) offers much on the "sociology of knowledge" that could have provided supportive material. George L. Mosse's seminal work *Towards the Final Solution* (1978) to some extent anticipated several of Proctor's concerns and would have been of great value in helping to provide a more general setting for *Racial Hygiene*. Robert Pois's *National Socialism and the Religion of Nature* (1986) devotes attention to the "environmentalist" aspects of Nazi biological science (the subject of Proctor's chapter 8, "The 'organic vision' "). More crucial, though, is the apparent overlooking of Leon Poliakov's *The Aryan Myth* (1974). If Proctor had consulted this work, he never would have made the statement, on p. 14, that "prior to Darwin, it was difficult to argue against the Judeo-Christian conception of the unity of man, based on the single creation of Adam and Eve." In this most important book, Poliakov points out that pre-Darwinian Enlightenment thinking, or at least an aspect of it, had furnished just such arguments and, in so doing, had laid the basis for the "scientific racism" with which Proctor is concerned. All the works cited above, to one extent or another, point out that the racist vision of National Socialism in particular and Western civilization in general was in fact a singular blend of cold scientism and an often politicized form of equally anti-humanistic nature mysticism, ironically enough a reaction to science's robbing the world of mystery. This brings into sharper focus the lack of consistency, discussed on pp. 290–291, between claims upon so called "value-free" science and the ability of the National Socialist movement to place it in the service of race, "of some mystical thing in itself."

None of this contradicts what Proctor has said in a book that is essential reading for any serious student of modern Western history in general and the history of science in particular. But, reflection on the themes presented in these works would have added to our appreciation of the terrible threat posed by a science devoid of humanistic concern. Moreover, the poignant centrality of this issue to science as part of the total human experience would have been cast into sharper and hence even more disquieting focus.

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A "New" Protein

Ubiquitin. MARTIN RECHSTEINER, Ed. Plenum, New York, 1988. xviii, 346 pp., illus. $59.50.

Ubiquitin was first isolated in 1975 from bovine thymus. Now, only 13 years later, Martin Rechsteiner has assembled a monograph that brings together much of the information that is available about this protein. Those already familiar with this small polypeptide, whether by intention or by serendipity, will not need to be convinced that this attention is due.

The uninitiated should understand that ubiquitin is a very special protein. As its name implies, it is everywhere, at least in eukaryotic cells, and is one of the most, if not the most, evolutionarily conserved proteins known. It is unusual, being found both free and covalently conjugated to other proteins. In some cases conjugates are rapidly degraded, whereas in others the function of the conjugated protein is probably modified. As Rechsteiner points out in his introduction, ubiquitin approaches actin, tubulin, and the histones in abundance. It is, therefore, surprising that it was not discovered until 1975. What is perhaps more surprising is that histones are among the proteins that are stably modified by ubiquitin, as are some cell surface receptors. Furthermore, since this volume was assembled ubiquitin has been shown to modify actin and to be associated with microtubules and the remnants of disrupted cytoskeletal structures characteristic of certain human neurodegenerative disorders, including Alzheimer's disease.

The book is an up-to-date (given the limitations of producing such a volume) collection of reviews by researchers who are active in diverse areas, ranging from intracellular proteolysis to chromatin structure and transcriptional regulation, the heat shock response, and cell-surface receptor function. The 12 chapters make it clear that ubiquitin is so remarkably conserved because all parts of the molecule are critically important, each possibly for different reasons. One chapter deals with the molecular genetics of the ubiquitin system. The ubiquitin multigene family is unusual, with loci encoding multiple, tandem arrays of spacerless ubiquitin repeats as well as loci encoding ubiquitin fused to unrelated carboxy-terminal extensions that include zinc finger motifs. Two chapters give current accounts of the enzymes that mediate the attachment and detachment of ubiquitin to and from other proteins. Recently, two of these enzymes (the loci encoding them having been identified earlier and independently) have been shown to be required for DNA repair and progression through the cell cycle.

Much of the book, seven chapters, deals with what is the most studied aspect of ubiquitin, its role in selective protein breakdown. Two describe the purification and structure of ubiquitin, the effects of chemical modifications on the activity of ubiquitin in this system, and the use of polyclonal immunochemical probes to study these complex processes. Several chapters discuss factors, including tRNA, primary sequences, and both normal and abnormal structural features, that are thought to play roles in targeting or selecting proteins for degradation via the intracellular ubiquitin- and ATP-dependent non-lysosomal proteolytic system. Rechsteiner and coauthors describe multisubunit, macromolecular ATP-stimulated proteases, one of which appears to preferentially degrade certain ubiquitin-protein conjugates in this system. The last of these chapters spends considerable time describing the apparently ubiquitin-independent degradation of proteins and the heat shock response in *Escherichia coli*, then ends by considering the possible relationship between selective protein degradation and the eukaryotic heat shock response. The identification of ubiquitin as a heat shock protein clearly signals that it may play a role in protecting cells (at least in higher organisms) from the effects of stress.