Life of a Biochemist

Otto Warburg. Zellphysiologer, Biochemiker, Mediziner, 1883–1970. HANS KREBS unter Mitarbeit von Roswitha Schmid. Wissenschaftliche Verlagsgesellschaft, Stuttgart, 1979. 168 pp. + plates. DM 29. Grosse Naturforscher, Band 41.

Otto Warburg was probably the greatest biochemist of the first half of the 20th century. His work on cell respiration, on photosynthesis, and on the metabolism of cancer cells was immensely important. We are fortunate in having this illuminating account of his life, work, and character from Hans Krebs, himself one of the great biochemists of our time, who worked in Warburg's laboratory from 1926 to 1930 and remained in close touch with him thereafter. This book is based on the earlier account of Warburg by Krebs, in English, in the *Biographical Memoirs* of the Royal Society (vol. 18, 1972, pp. 629–699). The German version, however, is significantly expanded from the earlier account, notably with respect to Warburg's family and background and his personal character and outlook. It also contains 31 well-reproduced photographs, which add to the interest of the text. For those who can read German, therefore, the present text is obviously the one to choose.

Otto was the son of the eminent physicist Emil Warburg (1864–1931), who was, among his other achievements, a pioneer in photochemistry. Emil was the first to verify experimentally Einstein's law of photochemical equivalence, and Einstein was a personal friend of the family. Clearly Otto was greatly influenced by his father, not only in his intense devotion to research but through his early acquaintance with photochemical techniques, which he later developed so brilliantly in his studies on respiratory enzymes and on photosynthesis. His passion for understanding fundamental life phenomena in terms of physics and chemistry was unflagging over a career of more than 60 years, interrupted only by his service as a cavalry officer in the First World War and the use of his laboratory in Berlin by the American military government for administrative purposes from 1945 to 1949. He was proud of his record in military service, although in the spring of 1918 he returned to civilian life after nearly four years of active service, and after receiving a letter from Einstein (given by Krebs in full) telling him that he had more than done his duty in the war and urging that his great talents should not be further risked at the front.

Otto Warburg in his laboratory, July 1966. [From *Otto Warburg*]

Warburg was a superb strategist in the design and execution of significant experiments and a master of terse and lucid style in presenting the results. His great work on cell respiration led him from the discovery of the iron-containing "respiratory ferment" (cytochrome oxidase) to the isolation and purification of the dehydrogenase systems of respiration and fermentation and the determination of the structure of the associated coenzymes. For the work on the respiratory ferment he received the Nobel Prize in 1931, but most of his greatest achievements came later. His work on photosynthesis and on cancer metabolism was also new and fundamental, but Warburg's interpretation of his results was clearly oversimplified, and later work has led other investigators to very different conclusions. Warburg's actual experiments, however, were always repeatable by others.

Krebs lists more than 500 papers from Warburg's laboratory, a considerable number of which do not bear his name, although they show the stamp of his strategic design and of his literary style. Warburg was more generous than many German laboratory directors in approving publication of such papers without attaching his name to them; but at the same time he ran his laboratory with autocratic authority.

Warburg was fiercely ready to resent what he considered to be unjust criticism of his work. Often he was quite unfair in judging both the motives and the compe-

tence of those who aroused his wrath. Sometimes he pursued them with sharp polemics, and he unnecessarily regarded as "enemies" those who happened to disagree with him. This weakness, which Krebs portrays frankly, was associated with Warburg's passion for scientific truth as he saw it. He could be extremely rude in getting rid of visitors when he did not want them to bother him, but he could be most charming, and a delightful host and conversationalist, with those whom he found congenial. He avoided lecture tours, public interviews, committee work, and other distractions in order to devote himself fully to his research.

Dedicated to science, Warburg never married, and he apparently had scarcely any close friends except for Jacob Heiss, who came in 1919 to manage his household and later his laboratory operations, for the rest of Warburg's life—a life that he apparently found fully satisfying. Warburg's long-term co-workers were highly skilled technicians and worked closely under his direction, although some eventually evolved into independent investigators. Many scientists came from Germany and from abroad to work with him. At least three Nobel Prize winners—Otto Meyerhof, Krebs, and Hugo Theorell—were profoundly influenced in their subsequent careers by the training they received, and the problems they worked on, in Warburg's laboratory.

In the Nazi era Warburg continued to pursue his research in Berlin, thanks to a decree by Hermann Goering that he was only one-quarter Jewish and could therefore be allowed to continue undisturbed. Some of Warburg's colleagues and admirers, especially in England and the United States, were personally alienated from him by his willingness to accept this form of coexistence with the Nazis rather than leave Germany and seek to continue his work elsewhere (a point Krebs does not mention). To Warburg, getting on with the work was the supreme objective, as long as it involved no compromise with truth as he saw it.

Krebs, in this relatively short book, portrays with skill and insight a great investigator who was also an interesting and unusual person. One could wish for more such short biographies of great scientists, but few authors could match Krebs in his combination of deep knowledge of his subject with literary skill and a keen interest in the history of science.

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Issues of Production and Consumption

Distortions of Agricultural Incentives. Papers from a workshop, 1977. THEODORE W. SCHULTZ, Ed. Indiana University Press, Bloomington, 1978. viii, 344 pp., illus. $12.95.

Agriculture, like the steel or petrochemical industries, is a means to an end. Its primary role is the provision of food and fiber for society. In the process it provides most of humanity with its livelihood; whether richly or poorly depends on many factors, some of which are treated in this book.

The two major public policy issues concerning agriculture in both the developed and the developing worlds are the adequacy with which agriculture supplies the world's food and the adequacy with which that supply is allocated among the world's 4-billion-plus population. There are extremely important linkages between the two issues, and these linkages are intimately tied up with incentives and disincentives for agricultural production. This book edited by Theodore W. Schultz, without doubt the dean of economists concerned about agricultural development, is aimed entirely at the first issue and virtually ignores the second.

Despite chapters on biological and environmental constraints on agricultural production (by Charles Pereira and Howard A. Steppler) and on institutional factors slowing the growth of food production (by Vernon W. Ruttan), the book is narrow. Neoclassical economists are quite good at understanding production effects of government policies and quite bad at understanding income distribution and consumption effects. The inevitable tendency is for economists to urge policy-makers to set optimal policies by production criteria and to "correct" any distributional problems through taxes or other transfer mechanisms that the politicians must manage on their own. But an analysis of the widespread disincentives to agricultural production that ignores their direct and indirect impact on consumption misses the real complexities of modern and traditional food economies.

The six chapters by Schultz, W. David Hopper, Gilbert T. Brown, Randolph Barker, Martin E. Abel, and G. Edward Schuh present the essence of the message: politicians in developing countries find it expedient in the short run to erect barriers to the "efficient" development of their agricultural sector, and these barriers become significant disincentives to agricultural production. Several of these chapters are devoted to enumerating the various forms disincentives can take and their likely impact on output. Although one author's underincentives are sometimes another author's overincentives, the tenor of the book remains that most governments are penalizing their agricultural sectors.

Schultz attempts to answer the obvious question why this is so:

> There are many "reasons" why governments undervalue the economic contributions of agriculture. These reasons are strung together by various ideologies, most of which have been "imported" from high income countries.
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> Even though the rural population in low-income countries is much the larger, the political market strongly favors the urban population at the direct expense of rural people. Politically, urban consumers and industry demand cheap food. . . .
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> Furthermore, the undervaluation of agriculture by governments is still being rationalized by an array of arguments that include the colonial heritage, the backwardness of agriculture, and its presumed low estate in contributing to economic growth. . . .
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> Currently, various arguments are advanced on behalf of welfare considerations with the implication that economic efficiency in agricultural production is at many points inconsistent with the welfare of the population.

Schultz argues that:

> The easy analytic road is to accommodate the purposes of government or, for that matter, to embrace any of the various internal special political interest groups. . . . Clearly, when economics is used to serve special interest organizations, it sells economic analysis short. Although governments obviously perform necessary functions, to make economics subservient to them regardless of what they do to the economy is to take the heart out of the utility of economics. When economists merely accommodate governments, they serve only to rationalize what is being done and lose their potential as educators. When this occurs, and it can be readily observed, economists become "yes-men" in the halls of political economy.

But the knife cuts both ways. One might wonder who is rationalizing the status quo more, Hopper, who argues in his chapter that tractors and large farms are necessary if Indian agriculture is to be more productive, or the economists who argue that hunger and malnutrition in India seem remarkably little related to India's food production and that fewer tractors and smaller farms would help rather than hurt the access of the hungry to food. It is at least as much of a "sell-out" to argue that problems of poverty should be dealt with through income transfer mechanisms that few Third World countries can operate effectively as it is to defend cheap food because