

material that was at his disposal. Today, Johnson's work on the founding of the KWG has been largely superseded by a comprehensive work on the KWG and the Max Planck Society, a work by many hands, including Johnson's (and mine): *Forschung im Spannungsfeld von Politik und Gesellschaft. Geschichte und Struktur der Kaiser-Wilhelm/Max Planck Gesellschaft*, edited by Rudolf Vierhaus and Bernhard von Brocke (Stuttgart, 1990).

Johnson's well-researched book is marred by his relentless wish to give it an all-embracing theoretical framework — hence the constant refrain that all that he details is evidence of Germany's "conservative modernization". On the one hand, there is nothing strikingly new about the thesis that nineteenth-century Germany assimilated modern institutions into an existing, largely authoritarian culture. But what other models for modernization did Johnson have in mind? Radical or revolutionary modernization? His efforts to ground this much-vaunted theory in historical facts, to link the institutional history of science to actual politics leads over and over again to the "fallacy of misplaced concreteness". One example — a central one — must suffice: it is true that Wilhelm II's prestige was damaged by the *Daily Telegraph* affair of 1908, but there is little if any evidence that this celebrated instance of his political ineptitude hastened his support of an enterprise that trusted advisors had submitted to him and that would have corresponded to his more rational impulses in any case. The author would have done better to make more plausible connections between particular facts and rely less on an abstruse and pretentious theoretical framework. It is also regrettable that a book about scientists — many of whom had a superb command of language — should make so little effort at literary distinction.

Johnson rightly emphasized the importance of American developments in German eyes. Scientists sensed the new rival, whereas many humanists lamented the possible intrusion. Johnson quotes from the great reactionary classicist, Ulrich von Wilamowitz-Moellendorf, who in defending the — unthreatened — position of the Prussian Academy of Sciences blames the Kaiser Wilhelm Institutes for having been largely financed by industry: "We cannot blame industry for that, but it is very American." In 1903, Fritz Haber had caught the modernizers' mood when he wrote after a visit to the United States: "The American [economic] challenge has become a common slogan, and Bismarck's sentence about the Germans who fear no one but God would seem in business circles gradually to be seriously amended: and a little the United States." *The Kaiser's Chemists* confirms that German ambivalence about America has a long and important history. □

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Groping in the dark

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Biophysical Electron Microscopy. Edited by P. W. Hawkes and U. Valdre. Academic: 1990. Pp. 517. £61.50, \$132.

Most microscopists, especially biological ones, like doing it in the dark, and it is not clear how welcome turning on the lights would be. Groping in the dark is not without its attractions and rewards. But for those who have tired of some of the more mundane pleasures, or who are stimulated by a detailed knowledge of the intricacies of the subject, *Biophysical Electron Microscopy* should provide hours of instruction and even pleasure.

As is traditional in such manuals, it opens with a detailed description of the equipment and its function. It is often amazing to discover some of the misconceptions harboured in this area, even by those thought to be quite experienced, and so a thorough grounding is invaluable. Basic anatomy focuses on the column, but gives a frank and useful discussion of a number of exotic variations as well as the more straightforward methods used by most. Chapters on instrumentation, electron-specimen interactions, image formation and contrast provide a valuable introduction that is often not found in books directed towards a biological audience. High resolution is discussed in detail and gives an insight into the sorts of new information that can be obtained using electron crystallography, while also introducing many of the problems that remain in this specialized field.

A monumental chapter on image processing is probably unrivalled in the literature in terms of thoroughness and rigour. This chapter alone would make the book invaluable for workers interested in a more quantitative view of structural biology. Radiation damage is treated in considerable detail and identifies many of the problems that stem from this area. Low-temperature techniques are treated a little superficially, but do give some good pointers to more specialized sources. Finally, a number of accessory techniques for determining composition (X-ray microanalysis, electron energy-loss spectroscopy, cathodoluminescence) are described.

Although undoubtedly valuable, the rather mathematical emphasis of this book may sometimes make it rather demanding on most biologists. At times, the expectations of the intended audience in terms of matrix algebra or even calculus may be exceeded and some areas would be more valuable with a greater emphasis on explaining basic principles in simple terms rather than only as equations. My impression is that 'biophysicist' is interpreted as physicist looking at biology rather than as a biologist using physical

methods to look at the living world.

A major problem for many biologists has been that most books on electron microscopy deal with it from the perspective of materials science. Clearly, a book with a distinctly biological perspective would be extremely valuable. Consequently it is with some considerable sense of frustration that one finds that so many chapters of the present book deal mainly with specimens, examples and problems drawn from materials science. Electron-diffraction patterns from silicon single crystals or AuZn alloy or high resolution lattice images of gold are of very limited usefulness to biologists. Such materials-science objects differ in a number of significant ways to biological material, most particularly in terms of radiation damage, contrast and the relative importance of dynamic effects. The reason that biologists do electron microscopy differently is far more related to the differences between specimens than to any lack of knowledge about the techniques concerned. In fact, the apparent lack of appreciation by some of the authors of the differences between biological and materials-science objects seriously limits the usefulness of this book. Although at least most of the background information is collated into one place (rather than scattered over several books on materials science), a real opportunity to discuss these points from a biological perspective has been lost.

The excitement of modern structural biology often seems lacking from this book. Macromolecular organization is one of the secrets of life and to most of its practitioners, biophysical electron microscopy is exciting because of the unique insights it can give into this area. The book is depressingly short of examples of the achievements of these techniques and where the subject is heading, and I doubt that a physicist would be enthusiastic about entering biology after reading it.

But notwithstanding these criticisms, *Biophysical Electron Microscopy* is a valuable background reference and will be an indispensable source book for anyone seriously interested in structural biology at anything other than the morphological level. Although it suffers from the usual problems of cohesion and emphasis common to most multi-author volumes, it does combine a very substantial amount of diverse and extremely useful fundamental information about electron microscopy and its underlying physical principles. It is not so much a question of whether it could have been done better, but rather that it is a very substantial achievement to have done it at all. It may well be that for some, in addition to telling them all they ever wanted to know about electron microscopy, it also tells them why perhaps they were quite correct to be afraid to ask. It may well not prevent biologists from groping in the dark, but they will at least have a better idea of how to do it. □

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