discussion of two philosophical issues. One is the place of science in the world; here, more prophet than futurologist, Feinberg strikes a righteous pose. He offers dogmatic pronouncements about a wide range of religious, ethical, political and sociological topics, which reflect mainly the unsophisticated views of the typical scientist-in-the-street. The other issue concerns the change in the nature of scientific explanation and the possible limits to understanding. Thanks to his professional background in modern physics, Feinberg has a much better grasp of this matter. He shows how the rise of the quantum theory has eroded some of the basic conceptual ingredients of explanation — foremost among them cause and effect. Moreover, many of the unsolved problems in both physics and biology pertain to highly complex systems in which tiny fluctuations in one variable have huge effects on other variables. The "chaotic" behaviour of such systems limits the degree to which we can hope to fathom them. Thus, as Feinberg points out to his regret, "future science may see more restrictions on what we are able to understand and predict". Also, because of "the immense expansion of scientific information . . . scientists can learn an ever smaller part of what is known and can concern themselves with an ever narrower segment of it . . . . Science is thus in some danger of losing its character as a cumulative body of knowledge". Despite his regret over these limits, Feinberg ends on an upbeat note, befitting his smiling, *simpatico* portrait shown on the dust jacket: "Present and future discoveries in science can transform human life. All of these represent bright prospects of future science".

It may be mean to cavil at this well-meaning essay by a scientist whose interests and concerns clearly transcend his research specialization. But, all the same, it would be negligent for a reviewer not to point out that, just as in the "hard" natural sciences, there are also professional standards in the "soft" social sciences, and that, just as in particle physics, in futurology triviality is even more grievous than error. □

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At the interface

D.H. Everett

Adsorption and the Gibbs Surface Excess.
By D. K. Chattoraj and K. S. Birdi.
Plenum: 1985. Pp.471.
$71.40, £56.53.

IN THIS book Chattoraj and Birdi have set out to demonstrate the central role played by the Gibbs surface excess in describing adsorption phenomena in systems involving liquid-vapour, liquid-liquid, solid-vapour and solid-liquid interfaces, and in biological structures. This attempt to present a unified approach to a wide range of phenomena is to be welcomed. Unfortunately, the treatment leaves much to be desired.

The arguments employed often lack the rigour and self-consistency essential in discussions of thermodynamics. Thus, in the introductory chapter, the surface tension is introduced simply as "surface energy", while in considering the equilibrium between bulk and surface phases the role of surface tension is ignored. Later, in Chapters 3 and 5, correct derivations of the equilibrium condition are given and the surface tension term is now included. In the earlier treatment the surface tension term is apparently hidden in the surface activity coefficient, as perhaps implied in the unhelpful comment that "the standard scale for the surface activity coefficient is uncertain". Elsewhere different definitions of surface activity coefficients are introduced: that they are different quantities is suggested by the comment that one must "use the appropriate reference scale". Which? Also puzzling is this statement:

> In the derivation of the Gibbs adsorption equation the contribution of the β-phase to the interfacial phase is implicitly neglected. The surface activity coefficients thus evaluated *in all probability* [my italics] include this contribution.

Words such as "in all probability" are unacceptable in a thermodynamic argument.

Description of the Gibbs method is, surprisingly, deferred until Chapter 3: it should have been in Chapter 1. The formal definition is correct, but its status is obscured by the comment that "this approach is extrathermodynamic but no mathematical error is involved in the postulate". There is nothing extra-thermodynamic in Gibbs's treatment: what it does is to provide a means of quantifying the macroscopic stoichiometric effect of the inhomogeneous distribution of matter in the interface. At no stage did Gibbs "imagine" that the "moles of solvent present in the interfacial region is zero". His definition is independent of any molecular model, a feature which gives it its power, usefulness and wide applicability.

The book is illustrated by a substantial body of experimental material drawn from a variety of systems, much of it originating from the authors' laboratories. Overall, one has considerable sympathy with Chattoraj and Birdi's objectives, which are to some extent achieved. But it is unfortunate that to get the best out of the book the reader has to be constantly on the alert to avoid being misled. □

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Breeding resources

A.D. Bradshaw

Crop Genetic Resources: Conservation and Evaluation.
Edited by J.H.W. Holden and J.T. Williams.
George Allen & Unwin: 1984. Pp.296. Hbk £25, $40; pbk £9.95, $14.95.

THE key to this book is on p.212. In a well-documented review amongst a group of similar papers, J.R. Harlan assesses the value of wild relatives of crop plants in modern plant breeding. If anybody thought that we could do without all this wild material, here is the corrective — a sober account of the improvements in ecological tolerance, disease and pest resistance, quality, yield and even modes of reproduction which have come from relatives of present crop plants. But at the same time Harlan illustrates the consequent dilemma: because this potentially valuable material is scattered through innumerable species around the world, it is almost impossible to know where the next important source will be.

This is of course only half the story. The enormous losses of natural and semi-natural environments and the increasingly widespread use of new crop varieties mean that this wealth of genetic material is rapidly being depleted. Landmarks in the growth of concern were two FAO/IBP conferences (1968 and 1973) on the conservation of crop genetic resources. Also in 1973, the International Board for Plant Genetic Resources was formed to bring some international organization into the many efforts which were then starting, including the international network of regional centres for crop research and genetic conservation.

Ten years have now passed. In the book there are 24 papers reviewing the progress that has been made, each written by people who are eminent in their field. It is their undoubted experience which leaves a feeling of great unease about the magnitude of the task ahead.

It is easy to define some of the difficulties. In the first part of the book, on seed storage, Roberts and Ellis show elegantly the progress that has been made in quantifying deterioration by predictive equations, and Hanson how we are becoming able to store even some recalcitrant seeds. Ellis and Roberts discuss programmes for monitoring deterioration, advocating important new systems of sequential probability ratio tests. But while the International Rice Research Institute had 25,600 accessions in 1974, it now has more than 50,000. Despite improvements, the problem remains enormous.

The second group of papers deals with the capture and retention of variability. Gale and Lawrence consider how to overcome the problems of the decay of variability in conserved material, while