course it is possible to destroy one's view of humanity by overindulging technology, but it is also possible to get the same result by overindulging religion, sex, art, business, sports, or virtually anything else. The main threat is not in our machines but in ourselves, almost always first in ourselves.

Although questions of ethics and social philosophy have tended to dominate studies of the philosophy of technology, this collection of essays shows that the full range of metaphysical, epistemological, and axiological questions arises quite naturally in connection with technology. Bunge is the premier contemporary system builder in philosophy, and it was to be expected that in his contribution he would systematically explore technology by way of the classical philosophical categories. I suspect, however, that a definition of metaphysics would have been useful here, for example, that metaphysical claims are synthetic a priori claims or claims about the world whose tests of truth are not dependent upon observation. On such a definition, claims like "With the help of technology man can alter certain natural processes in a deliberate and planned fashion" would not be metaphysical, contrary to Bunge's claim (p. 271). Bunge's views about pure science and technology are such that mission-oriented science becomes identified with technology. His idea of having two ethical codes, one "individual" and one "social," seems to entail the moral respectability of ethical egoism, which I imagine he dislikes as much as I do.

P. Caws draws instructive parallels between praxiology and epistemology, and Wojick skillfully compares disputes about evaluative policy with Kuhnian-type paradigm disputes. Mitcham's discussion of the etymology of "techne" and "technology" is superb.

In a helpful introductory essay, M. Kranzberg notes that he wishes the volume contained a paper written from a cliometric (quantitative historical) point of view. It seems to me that a healthy dose of American pragmatism with its naturalistic view of value would have been instructive. Modesty probably should, but doesn't, prevent me from suggesting that my *Foundations of Decision-Making* (Canadian Library of Philosophy, Ottawa, 1978) provides a pragmatic, cost-benefit approach to solution of some of the problems raised by these authors.

ALEX C. MICHALOS
Social Indicators Research Program, University of Guelph, Guelph, Ontario N1G 2W1, Canada

Ecological Classification

Plant Strategies and Vegetation Processes. J. P. GRIME. Wiley, New York, 1979. xii, 222 pp., illus. + plates. $28.95.

This book is an attempt to classify plant species on the basis of their ecological role or function. The task is particularly difficult with green plants, since they all consume the same basic resources (light, CO_2, and minerals) and produce the same basic metabolites. Consequently ecological classifications have to take into account the ways in which a plant gathers resources and interacts with other plants and with herbivorous animals. Traditional classifications have been based on, for example, morphological traits (herbs, shrubs, trees, vines, and so on) or form and function (hydrophytes, mesophytes, xerophytes, and so on) or the position of the perennating bud (the well-known Raunkiaer classification). None of these schemes, although they are useful, can be said to be entirely satisfactory. What is needed is a simple classification that is universal and is based on a theory that predicts the ecological forms given some independent environmental variables.

One of the big problems in arriving at a satisfactory ecological classification of plants is their great plasticity. For example, a species may develop into a small tree in one environment and into a large shrub in another or be an annual in one and a biennial or even longer-lived in another. To avoid this problem, the concept of "strategy" has been introduced. A strategy is defined in the present book as "groupings of similar or analogous genetic characteristics which recur widely among species or populations and cause them to exhibit similarities in ecology." By working with the genetic potentials of a species, rather than the expressed phenotype, the problem of plasticity is bypassed. Unfortunately, it is specific phenotypes, and not genetic characteristics, that are responsible for the ecological properties of plants. Furthermore, the inference of phenotypic characteristics from genotypes and vice versa is not operationally possible at present.

The theoretical basis for the classification proposed by Grime is very simple and is based on two supposedly independent environmental variables: stress, defined as "phenomena that restrict photosynthetic production," and disturbance, "the partial or total destruction of the plant biomass." On the basis of these two variables, four basic environments and strategies are identified: Environments with high stress and high disturbance are so inhospitable that no plants can grow there. In environments with high stress and low disturbance, such as deserts or the arctic tundra, the successful strategist is the stress-tolerant, that is, a plant type that is able to survive with low resource levels. In environments with low stress and high disturbance, such as agricultural fields, the successful strategist is the ruderal, that is, a plant type capable of quick regeneration because of either copious seed production or asexual vegetative reproduction. In environments with low stress and low disturbance, there will result a dense cover of plants competing for the abundant resources, and the successful strategist is the competitor, a plant type that allows the efficient harvesting and utilization of these resources. Since there are environments with intermediate degrees of disturbance and resource abundance, some additional, intermediate strategists are described: stress-tolerant ruderal, stress-tolerant competitor, competitive ruderal, and a kind of general intermediate type, the competitive-ruderal-stress-tolerant type.

The bulk of the book is devoted to a description of the phenotypic characteristics associated with the various strategies. Nowhere is information presented regarding the pattern of inheritance. Of particular interest is the treatment of growth as an adaptive characteristic. Another interesting aspect of the book is the separate description of the characteristics of the adult plant, called the established phase, and of those of the seedling, called the regenerative phase. This part of the book is the most interesting and contains well-documented data.

The book suffers in this reviewer's opinion from two major defects, which put the validity of Grime's classification in doubt. The first defect is in the definition of and the assumed independence of the two environmental factors that are supposed to drive the system. What Grime has done is to revive under different terminology the old issue of density-dependent and density-independent mortality. What he calls disturbance is classically associated with density-independent mortality, and resource abundance is usually associated with density-dependent mortality. As has been repeatedly shown, these two sources of mortality cannot always be identified, nor are they truly independent. For example, a nine-month drought in Arizona is seen by a plant as part of that environment's harshness and leads to what is defined as density-dependent mortality, while nine months of drought in New England would be a source of severe

density-independent mortality. The effect of the environment on the vegetation is determined by the characteristics of the vegetation.

The second, and in this reviewer's opinion more serious, problem is the lack of an attempt to develop a good predictive theory or to identify the physicochemical and physiological constraints that determine that a species with a given set of morphological and physiological characteristics can grow and survive only under a limited number of environmental conditions.

In spite of these drawbacks, plant population biologists and ecologists will find a lot of information and a wealth of correlational data that are interesting and thought-provoking. The book is well written and well presented.

OTTO T. SOLBRIG

Gray Herbarium,
Harvard University,
Cambridge, Massachusetts 02138

Ion Diffusion

Physics of Superionic Conductors. M. B. SALAMON, Ed. Springer-Verlag, New York, 1979. xii, 256 pp., illus. $29.80. Topics in Current Physics, vol. 15.

The name "superionic conductor" was introduced by Walter Roth and Michael Rice in 1972 to describe a class of ionic solids that conduct ions extraordinarily well. As Salamon notes, "hyperionic" would be a better term than "superionic," since the Latin "super" and the Greek "ion" make strange word fellows. Nonetheless, "superionic" is now accepted in this extremely old field of electrochemistry, which has only recently become a branch of solid state physics. Although Michael Faraday observed in 1834 that AgI seems to have unusual properties upon heating, it was not until 1974 that solid state physicists began to study these solids with modern methods. In that year Bernardo Huberman gave the only contributed paper on the subject at a meeting of the American Physical Society, and this reviewer asked the only question. Since then the topic has played a larger role, with many scheduled sessions each year.

The present volume is a collection of eight contributed chapters on the physics of ion diffusion. Physicists have brought to this topic a variety of experimental techniques and goals quite different from those of the traditional electrochemists. The physicist wants to know why the ions move so easily through the solid and whether there are collective phenomena. The electrochemist wants to build batteries for electrical vehicles or peak power loading and is usually concerned with chemical questions of stability and compatibility. Although there are numerous other review volumes by electrochemists, such as *Solid Electrolytes* edited by Hagenmuller and van Gool (Academic Press, 1978), the present volume is the first entirely devoted to the physics.

One example of a physicist's viewpoint concerns phase transitions. High ionic conductivity is a result of ion disordering, which is often caused by an order-disorder phase transition. Yet it was not until the work of Salamon that the modern ideas of critical phenomena were applied to investigate the phase transitions. Salamon showed that the critical properties in $RbAg_4I_5$ revealed the nature of the order parameter, which enabled him to construct realistic models of the ion disordering. His chapter on phase transitions in the book under review gives a good summary of this work. He also classifies the phase transitions within Landau's system and provides a framework for the entire subject of phase transitions in these materials.

Another difference between the physicist and the electrochemist is in the materials they choose to study. The electrochemist wants materials to use in batteries, which invariably have a minimum of 50 atoms in each unit cell of the crystal. The physicist wants to study how ions diffuse in a collective system and chooses the simplest framework for the study. Thus physicists investigate the simple systems such as the silver and copper halides and the fluorite materials such as CaF_2 and $SrCl_2$.

Other chapters in the volume review the experimental techniques of x-ray absorption fine structure, neutron scattering, nuclear magnetic resonance, and light scattering. Each technique has been extensively used to study simple ionic solids, with a focus on description of the mechanism of ion diffusion. Does the ion hop from site to site, with a relatively large dwell time on each site, or does it continuously migrate? Is the ion disordering a collective phenomenon or an individual one? Is it necessary to have a low-frequency phonon mode? Not all of the experimental techniques reviewed in the book provide equal insight. Of those included, neutron experiments seem the most useful, since they can be used to measure both individual and collective modes. One criticism of the book is that it lacks a chapter on x-ray scattering, which may be the single most useful experimental tool for measuring ion disordering. Geisel's theoretical chapter on continuous stochastic models is the best introduction to the subject ever written.

The book is technique-oriented, in that each chapter is written by an expert in some experimental or theoretical technique who advocates that particular method and its associated interpretative models. It might be useful to have a review volume in which each chapter is about a single material. Each chapter author would be assigned a solid, for example AgI, and be asked to explain its behavior by unraveling the competing and conflicting claims of different experimental methods. Only in that way will we attain a true picture of ion motion in a collective system.

G. D. MAHAN

Department of Physics,
Indiana University,
Bloomington 47401

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