hensive view of the progress made in observing the solar granulation between 1967, when the first edition of this book was published, and 1982, the most recent year for which developments are considered. Observations of the solar granulation are not definitive for several reasons. A major reason is that the spatial scale associated with the granules lies near the resolution limit imposed by instrumentation and by turbulence in the earth's atmosphere. Attempts to overcome limitations of resolution are thoroughly discussed. Most information about velocities, temperatures, pressures, and densities within the granulation comes from analyzing spectral lines formed in the solar atmosphere. Unfortunately, line profile diagnosis of the highly inhomogeneous solar atmosphere is not straightforward. No uniqueness is associated with physical quantities obtained by inverting line profile observations. Particular profiles can be synthesized by adjusting either temperature or velocity distributions. A related problem is introduced by the simultaneous existence of several dynamical processes in the solar atmosphere. Granular effects must be separated from those caused by oscillations and waves. However, these processes overlap in both their temporal and their spatial behavior. A figure in the book showing the height dependence of the velocity fluctuations is a good example of discrepancies introduced by using different methods to separate these motions and to interpret the observed line profile shifts. The book presents a lively account of these problems and is careful to point out where controversies exist.

The Solar Granulation provides a basic introduction to the theory of convection, including the two most widely used approximations, the anelastic and the Boussinesq, and describes problems that are encountered when the convecting medium becomes highly turbulent. Theories of astrophysical convection are described, and the problems encountered when radiative heat exchange between convecting elements becomes important are discussed. Two models of convection that directly attempt to explain the granulation are treated in more detail. Although the authors attempt to make this treatment of convective theory accessible to nonspecialists, it would be difficult to follow without previous experience in fluid dynamics and prior knowledge of the literature. An attempt to distinguish between the well-ordered appearance of the granulation and the more chaotic character of smaller-scale turbulence is confusing. The more accepted idea that the granules are best described as the energy-containing eddy of a turbulent convective spectrum containing a wide range of sizes is not presented. Several of the more developed schools of thought on stellar convection (such as that of Unno and his colleagues in Japan) are not well represented. However, the authors do provide a comprehensive picture of the great difficulties encountered in developing a convective model and of the shortcomings of current models in explaining the solar granulation.

The book concludes by discussing how some properties of the granulation can be interpreted using granular models and by describing current efforts to use knowledge of the solar granulation to deduce information about similar processes on stars. Researchers in this rapidly expanding field will find this latter information very useful. The book should serve as an excellent introduction to those wishing to study the dynamical properties of stellar atmospheres and as a comprehensive guide to research on the solar granulation. It is a must for any complete astronomy library.

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A Diverse Group of Wetlands

European Mires. PETER D. MOORE, Ed. Academic Press, New York, 1984. x, 367 pp., illus. $75

Mires include all peat-forming ecosystems, and therefore this book deals with a very diverse group of wetlands. It is the second major book on peatlands published in about a year. The first book, *Mires: Swamp, Bog, Fen and Moor*, edited by A. J. P. Gore (Elsevier), was in two volumes: one dealing with conditions and processes and the other describing mires in different parts of the world, especially with respect to regional variation. *European Mires* overlaps to some extent with parts of the second of these volumes, but the differences are more important. In general, it provides much more detail on the floristic composition of mires than the volumes edited by Gore, but much less on processes. The nine chapters by 15 contributors deal primarily with the phytosociology of mires (80 percent) and with stratigraphy and palynology (17 percent), with little space devoted to other topics such as chemistry and hydrology.

A paper on the classification of Finnish mires by Eurola, Hicks, and Kaakinen is by far the longest contribution, almost a third of the book, and certainly the most informative. A 23-page introduction, based mainly on Eurola's earlier work, is devoted mostly to the environmental factors that cause the differences in mire vegetation. The introduction contains many insightful diagrams. In several cases an effort is required to grasp the contents of the diagrams, but all are packed with information. Finnish mire ecology has retained its own identity in spite of a strong Swedish influence, primarily that of Du Rietz, Granlund, Osvald, and Sjörs. For readers familiar with the Scandinavian peatland literature, most of it in German, Finnish, and Swedish, this section is a valuable summary of current thought in Finnish mire ecology that includes some new ideas; for others it will provide interesting insights into the environmental control of mire vegetation. The main part of this chapter consists of a key to a description of the Finnish mire types. A glossary of terms and an appendix with the names of Finnish mire types and their German and English equivalents are useful additions.

A paper on Estonian bogs by Masing is perhaps most important for its clear illustration of the value of complementary approaches and different scales in describing the vegetation of peat bogs. Masing also shows that the concept of synusiae (one-layered communities, based on Lipmaa's ideas) can be used to advantage in studies of productivity as well as in describing the vegetation.

Rybniček gives an overview of the vegetation of the mires of the central European mountains, from the Alps to the Carpathians. The continental and oceanic influences in this vegetation are small, and affinities are mostly with the boreal and subarctic mires. The other papers supply details on the mires of other parts of Europe.

In a book on European mires, one would expect a better geographical balance. About 44 percent of the book deals with the British Isles, 30 percent with Finland, 15 percent with central Europe, and 8 percent with the Baltic States. There is no information on the mires of European Russia or on those of the northwest European plain from France to East Germany. Not much is left of the latter, it is true, but a compilation of what is known is much needed, and this volume would have been the appropriate place for it. The range of peatlands discussed varies also from paper to paper. Masing's paper is restricted to the bogs of Estonia, whereas in a chapter on wet-

land communities in Ireland bogs and blanket mires are specifically excluded.

The editor is well known for his palynological and stratigraphical studies of mire development. He has brought together in this volume a great deal of information on the vegetation of European mires that is not available in English and is often known only locally. The book is well edited, with few spelling errors, and is written in surprisingly good English. The editor obviously made a major effort in editing the papers by non–English-speaking contributors. Overall, this is a helpful reference book on the vegetation and classification of European mires.

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Aging in Cells

Cellular Ageing. H. W. SAUER, Ed. Karger, Basel, 1984. x, 276 pp., illus. $88.75. Monographs in Developmental Biology, vol. 17.

This slim, handsome volume brings together a group of 17 papers (presumably a subset of the best) submitted in response to the announcement of the 20th annual competition of the Heinz Karger Memorial Foundation. In brief introductory remarks by Dr. Thomas Karger and Steven Karger (this event is obviously a family affair), we learn that Dr. Heinz Karger was a director of the publishing house of S. Karger from 1935 until his death in 1959 and that the Foundation has been honoring outstanding scientific researchers from a diversity of fields for the past 20 years through financial prizes awarded as a result of regular competitions. The 20th competition, which I understand was for a cash award of some 20,000 Swiss francs, dealt with the theme of cellular aging. It departed from tradition by permitting review papers as well as reports of original research and by the publication of a collection of the submissions in book form.

The book contains accounts of some outstanding research, and these include the papers by the two prizewinners (who shared the award), Thomas B. L. Kirkwood and James R. Smith. Both are comparatively young investigators, which is a good omen (although we gerontologists have special affection for late bloomers). Smith is an expert in mammalian cell culture and has produced (often in collaboration with Olivia Pereira-Smith) a most elegant series of papers dealing with the phenomenon of clonal attenuation of normal human diploid cells. Here is an example of a line of gerontological investigation (pioneered by Leonard Hayflick and Paul S. Moorhead) that was pretty much ignored by a number of tumor biologists, who for years utilized, almost exclusively, such immortal cell lines as 3T3 and BHK for their research on in vitro "transformation." Smith's paper describing in vitro demonstrations of replicative mortality of fibroblasts is "must" reading for any investigator interested in the regulation of cell proliferation and the general problem of proliferative homeostasis. A good companion piece to Smith's paper is David E. Harrison's description of his nicely designed investigations of the serial replication of hemopoietic stem cells in vivo. Harrison believes his evidence strongly suggests that these stem cells have an essentially unlimited replicative potential.

Kirkwood is primarily a theoretical biologist, though he has collaborated closely with an experimental geneticist, Robin Holliday (who, incidentally, has two contributions in the volume). In his review essay, Kirkwood argues compellingly that adaptive explanations of aging are unsound and reviews his "disposable soma" theory of aging, which predicts that, in organisms that are interoparous (reproduce repeatedly) and in which, therefore, one does not observe the tight coupling between reproduction and somatic death found in organisms that are semelparous (reproduce only once), the level of repair of macromolecular damage to somatic cells is insufficient to prevent cumulative damage and, eventually, organismic death. He believes there is a trade-off, in evolutionary strategy, between the energy required for somatic maintenance and that required for reproduction, the investment of resources in maintenance and repair of the soma being always less than what is required for indefinite survival.

Other contributions include a series of papers on senescence of the immune system (including a very useful review by M. E. Weksler and G. W. Siskind), which is the most fruitful system for the investigation of how cell-cell interactions might be altered during aging; a timely review by D. M. Bowen of the selective vulnerability of cholinergic neurons, a topic of immense clinical importance; comparisons between in vitro and in vivo aging, including a description by M. T. Flood and colleagues of a new cellular model system for aging research, human retinal epithelium (photographs of which are displayed on the book jacket); and a number of papers on cytoplasmic aging. Among these last papers, those by M. M. B. Kay and D. J. Cummings are of special interest. Kay reports evidence that a specific transmembrane polypeptide undergoes proteolytic degradation in a variety of mammalian cell types during aging. Cummings reports on a series of elegant molecular genetic studies that establish a correlation between the excission and amplification of segments of mitochondrial DNA and the clonal senescence of the fungus *Podospora anserina*.

I have little hesitation in recommending the book to my colleagues in gerontology. It is not a systematic or balanced representation of the field, however, and non-gerontologists are likely to be disappointed by it. Nevertheless, the editor and his colleague K. J. Aufderheide (who was given the awesome assignment of writing an integrated overview of this heterogeneous material) have done a creditable job, and we can be grateful to them for persevering.

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Reprints of Books Previously Reviewed

In Search of Mind. Essays in Autobiography. Jerome Bruner. Harper and Row, New York, 1984. Paper, $6.95. Harper Colophone Books. *Reviewed* **224**, 720 (1984).

Man Discovers the Galaxies. Richard Berendzen, Richard Hart, and Daniel Seeley. Columbia University Press, New York, 1984. $30; paper, $10.95. *Reviewed* **199**, 763 (1978).

The Zapotecs. Princes, Priests, and Peasants. Joseph W. Whitecotton. University of Oklahoma Press, Norman, 1984. Paper, $9.95. *Reviewed* **220**, 661 (1978).

Books Received

Asymptotic Theory for Econometricians. Halbert White. Academic Press, Orlando, Fla., 1984. x, 230 pp. $39. Economic Theory, Econometrics, and Mathematical Economics.

Atlas of Sedimentary Rocks under the Microscope. A. E. Adams, W. S. MacKenzie, and C. Guilford. Halsted (Wiley), New York, 1984. vi, 104 pp. Paper, $24.95.

Living and Working in the Sea. James W. Miller and Ian G. Koblick. Illustrated by William Boggess. Van Nostrand Reinhold, New York, 1984. xiv, 433 pp. $32.95.

Living with the Louisiana Shore. Joseph T. Kelley *et al.* Duke University Press, Durham, N.C., 1984. xii, 164 pp., illus. $22.75; paper, $9.75. Living with the Shore.

Making Money with Your Home Computer. Dana K. Cassell. Dodd, Mead, New York, 1984. xii, 143 pp., Paper, $5.95.

Zoological Philosophy. An Exposition with Regard to the Natural History of Animals. J. B. Lamarck. Introductory Essays by David L. Hull and Richard W. Burkhardt, Jr. University of Chicago Press, Chicago, 1984. lxvi, 458 pp. $30; paper, $15. Translated from the French edition by Hugh Elliot.
in Mechanics and Thermal Sciences.