sector's labor-intensive production techniques create numerous jobs and seem to approximate the "appropriate technology" that United Nations development specialists advocate. Nevertheless, because this output is not identical to that produced by large, capital-intensive firms, one paper recommends measures (p. 277) that would in effect destroy the small-scale sector.

Likewise, the authors give little attention to the possibility that promotion of local electronics production may impede the achievement of other important development objectives. The technical and administrative resources available to an LDC at any point in time are usually limited. A decision to allocate those resources to a local electronics industry may mean that less R & D is done on domestic food production. Electronic technology can be imported, and usually from a number of competitive suppliers. By contrast, agricultural know-how is ecologically and geographically specific and must be developed locally. Hence an LDC may face a trade-off in which promoting domestic technical capacity in electronics involves high costs in terms of local agricultural development. Only one of this study's ten authors even mentions this trade-off. The others seem to have adopted a technological-prowess rather than a human-welfare view of development.

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Compact Objects

Black Holes, White Dwarfs, and Neutron Stars. The Physics of Compact Objects. STUART L. SHAPIRO and SAUL A. TEUKOLSKY. Wiley-Interscience, New York, 1983. xx, 646 pp., illus. $39.95.

The story of the discovery of compact objects—white dwarfs, neutron stars, and (still controversial) black holes—has been widely recounted in astronomical texts and popular books. There is general understanding of how these stellar corpses can be resurrected by simply pouring gas on them or letting them spin. This is one of the great successes of contemporary astronomy. However, so incessant and superficial appear the claims for new black holes and pulsars that the bystander might assume that the subject has rather feeble physical underpinnings. Not so. Neutron stars and black holes were seriously discussed by a distinguished series of physicists and astronomers (including one of the 1983 Nobel laureates) long before there was any observational evidence for their existence. White dwarfs were correctly interpreted within months of the formulation of Fermi-Dirac statistics. For over 50 years compact objects have fascinated scientists who have found in them arenas for the discovery of new effects through the application of physical principles under extreme conditions. It is extraordinary just how many of these effects are actually observed.

Black Holes, White Dwarfs, and Neutron Stars is the first serious textbook to consolidate this research. The authors, both active researchers in the field, have taught a graduate course on the subject at Cornell for several years. The book is firmly based in fundamental physics and observational astronomy. The equation of state for a degenerate electron gas is derived in considerable detail and then used to construct white dwarf models; likewise for the equation of state at nuclear densities and neutron star models. Cooling rates, which dictate the luminosities of isolated stars, are then calculated carefully. A short chapter on general relativity (possibly unnecessary in view of the excellent textbooks available) precedes a concise treatment of the standard results on the geometry of black hole space-times. The observational status of all three types of star is critically examined, and the reader is left in no doubt about the reality of neutron stars or, in contrast, about the genuine uncertainty that still lingers around the best black hole candidate, Cygnus X-1. Perhaps the most celebrated recent observational success—the quantitative confirmation of the general relativistic prediction of orbital decay through gravitational radiation in the binary pulsar PSR 1913 +16—is clearly described, and the incomplete but potentially just as decisive theory of stellar collapse is carefully outlined.

The book can be unreservedly recommended as a graduate textbook as well as a researcher's vade mecum. Among its many strong features is a consistent and clear distinction between generally accepted and applied theory, such as the Kerr metric, and still-controversial issues, such as the equation of state above nuclear density and pion condensation. There are over 250 exercises, many of which involve numerical solution—excellent training for the student. (This reviewer found the answer to a current research program worked out in one of them.) Basic principles are emphasized throughout by well-posed questions carefully answered and by an avoidance of some of the softer and possibly ephemeral lines of inquiry. The historical development of the subject is carefully sketched.

Of course, there are omission and superfluity. The subjects of surface effects on neutron stars and settling in white dwarf atmospheres are curiously absent. The difficult subject of radio pulsar emission mechanisms is largely, and probably wisely, avoided. The chapter on supermassive stars is quite out of place and is a poor reflection of contemporary research on active galactic nuclei. However, these are minor stylistic issues that cannot detract from the book's overall clarity and accuracy. "Astronecroscopy" flourishes and is well served by this excellent textbook.

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Austral Botany

Flora of Tierra del Fuego. DAVID M. MOORE. Line drawings by R. N. P. Goodall, Flora Patagónica, and S. Parkinson. Anthony Nelson, Oswestry, Shropshire, England, and Missouri Botanical Garden, St. Louis, 1983. x, 396 pp. $99.

Tierra del Fuego is one of the most remote areas of the world, climatically inhospitable and sparsely populated. Known to the public mostly from sporadic border disputes between Argentina and Chile and perhaps from stories of tall ships inching their way around Cape Horn, Tierra del Fuego has not been a focus of intensive botanical research. The publication of a current flora of the area is a scientific achievement in its own right. However, the importance of this work goes beyond this. Oil drilling is under way in Tierra del Fuego, and the population is increasing. Comprehensive ecosystems studies are needed to predict the degree of damage to the Fuegian environment that might occur and to find measures to keep the perturbations at a minimum. Moore's *Flora of Tierra del Fuego* provides a basic tool for such studies.

Several aspects of this flora are outstanding. For example, there is a table that summarizes the chronology of plant collections in the area that makes fascinating reading. One can sense the difficulties the first explorers experienced when they collected their specimens and assembled their plant presses. Not only names of collectors are given but also dates of visits, collecting areas, and the

sizes of collections when the information was available. The brief description of climate and soil is very useful but also shows how little we know. One chapter shows the geographical affinities of the flora, which, not surprisingly, demonstrates the close relationship with the vegetation of the east and west facing slopes of the Andes further north. Of special phytogeographical interest is that 7 percent of the Fuegian taxa show affinities with the flora of the islands surrounding Antarctica, including New Zealand and Southern Australia. The short summary of the principal vegetation zones, the base for a systematic study of the plant communities, is helpful, and the index of Indian names and uses of plants is an interesting feature not frequently found in a flora. Still another important asset is the comprehensive bibliography. The difficulties that have been overcome by the author in compiling this bibliography can be appreciated only by someone who has tried to find bibliographic information in poorly funded university, government, and private libraries of South America.

The systematic account includes all the 545 recognized species in Tierra del Fuego; of these 128 species have been introduced, accidentally or deliberately, from Europe. The keys are workable, and the numerous illustrations are superb. The many distribution maps and habitat indications make this flora a tool that can be used by any person with a simple dissection microscope and some biological training, although the inclusion of a detailed map of Tierra del Fuego would have been desirable. Too many of the habitat indications are difficult to localize.

The book has only one shortcoming that should be mentioned. This is the lack of any Spanish translation. Many persons in Argentina and Chile who might be interested in using this flora are not in full command of the English language. A translation of the description of the vegetation zones and the principal plant communities would have been a valuable addition, as would a Spanish version of the glossary to the systematic account, since many of the terms are not easily found in general dictionaries.

As it is, Moore's *Flora of Tierra del Fuego* is a beautiful and important work that will play a major role in the further exploration of the ecosystems of the southern tip of South America.

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The Psychology of Learning

Conditioning and Associative Learning. N. J. MACKINTOSH. Clarendon (Oxford University Press), New York, 1983. viii, 316 pp., illus. $29.95. Oxford Psychology Series, No. 3.

Concern with conditioning and learning in infrahuman animals has a long and rich heritage. One can trace its origins in the associationism of British philosophy and in the reflex view of Russian physiology. For many years it was the dominant strand of American psychology. All of these traditions have sensed the importance of adaptation of the individual organism by learning from its experiences. They have shared the view that understanding the way in which learning occurs is a first task in understanding behavior and experience. And they have shared the view that a major example of such learning is conditioning and the formation of associations.

During the middle of this century this view was so prevalent that laboratory experimental psychology was almost coextensive with the study of learning. Great promises were made, grand schemes were constructed, and hopes ran high that all of behavior could be understood in terms of conditioning. Every psychology student knew well the names of Hull, Guthrie, and Tolman, not to mention Skinner and Pavlov. Yet today much of that is changed. Animal learning is not the "hot" area of experimental psychology, and the names of workers in the field hardly roll off the tongues of students. It is still not entirely clear what happened. Partly graduate students were attracted by competing fields that seemed to offer promise: cognitive psychology and neurobiology. Partly, the study of conditioning did not make good on its overzealous promises of application to all of behavior. Partly, the field was perceived as continuing to grapple with old problems without making much progress. The result is that conditioning and learning now represent a relatively small field in psychology, populated by specialists who are disappointingly uncommunicative with their colleagues in allied fields.

This state is all the more lamentable because in fact the last 20 years have seen remarkable changes in the field. We now have available important and cohesive bodies of knowledge about certain elementary learning processes. Moreover, although there is by no means unanimity within the field there are quite useful quantitative theories of associative learning processes that have remarkable predictive and explanatory power. These theories hold considerable promise for detailed guiding of the neurobiological investigation of learning. They also have potential as providing a basis for some of the more complex performances that currently hold the attention of cognitive psychology.

In good part this progress has been made by concentrating on one particular form of learning, Pavlovian conditioning, and returning to the insights of surprisingly unread authors such as Pavlov and Konorski. But it also reflects a change in the attitude of students of learning. They are increasingly willing to attribute to the organism quite sophisticated knowledge, but they continue to seek simple ways in which that sophistication can be achieved. Truly impressive gains have been made in accounting for learning in terms of reconceptualized notions such as excitation, inhibition, and contiguity.

It is the current state of knowledge of this field that Mackintosh attempts to capture in this book. The goal is to describe at high level current thinking about conditioning as it is studied in infrahuman organisms. As the author points out, this is in some sense a theoretical book. But it presents a consensus of the field rather than the author's own theoretical stance. The introductory chapter emphasizes that exciting changes have taken place in the field. Several of the subsequent chapters discuss these changes under rather standard headings, such as "Classical and instrumental conditioning." But other aspects of the book's organization reflect these changes more directly, such as the chapters on contiguity and contingency and on the "laws of association." The result is a book that indeed captures much of the field.

This is not a book one would casually recommend to a novice. The writing style is excellent by any standard. And Mackintosh is a scientist of unusual acumen who has the ability to summarize issues and alternatives with a flare. But the book appears to have been written for those who already have considerable background. For such readers the book provides a valuable, scholarly, and balanced summary. But for those less acquainted with the field it may often seem impenetrable. This is a field that prides itself on elegance of design and precision in the selection among alternative hypotheses. Mackintosh's discussion superbly captures that sytle. But to the uninitiated it may sometimes seem like endless nit-picking over procedures and needless elaboration of implausible explanatory alternatives. The very discussion that makes this book valuable for