Vignette: Summer Advisory

Australian surfing authority, Thor Svenson, once said that "choosing a (surf) board is a very individual thing, like choosing a wife or girl-friend, almost." I never fail telling my students that choosing the first technical book to be read from cover to cover on a long vacation is as important as choosing a surfboard.

—G. *Korvin*, in *Fractal Models in the Earth Sciences* (Elsevier)

Dutton (p. 185), "the stodgy, merely supportive, and unresponsive 'ugly sister' of neurons . . . is emerging from its cocoon to exhibit colorful wings of its own." In spite of the neglect by textbooks, there has always been a dedicated core of research workers who have believed in the importance of glia. More general interest in these cells has ebbed and flowed, with each wave lasting a decade or two. Currently glia research is riding the crest of such a wave, propelled by the invention of a number of methods enabling closer scrutiny of these formerly inaccessible cells.

The word *neuroglia* (*Nervenkitt* in German), meaning "nerve-glue" or "nerve-putty," was coined by Virchow around the middle of the last century. As the term implies, Virchow believed that glia was the equivalent of connective tissue, holding nerve cells together and giving shape to the brain. A few decades later, scientists began to question the assumption that these cells were inactive and played merely a structural supportive role. Ideas about their true functions remained, however, purely speculative for a long time. In the absence of experimental data, tenuous inferences were made on the basis of morphology alone. That some of these guesses were right on target attests to the astuteness of some of the early thinkers.

Histologists divide glial cells into three classes: astrocytes, oligodendrocytes (sometimes known as oligocytes), and microcytes (also called microglia). Of oligodendrocytes we know that they lay down and maintain the fatty insulating layer (myelin) that surrounds nerve fibers (axons). Microcytes are normally few in number, but they proliferate in response to infection or injury. They are involved in defense and immune reactions of central nervous tissue. The astrocytes, however, remain mysterious. Although *Astrocytes* focuses on these enigmatic cells, the volume also gives some attention to the other glial subtypes, with chapters devoted to the interactions of astrocytes with oligodendrocytes and microcytes, as well as with neurons and even vascular endothelial cells.

The recent surge of glia research has been made possible by technical advances in cell culture, biochemistry, immunochemistry, molecular biology, and molecular genetics. The advances made in cell culture are most significant, having enabled the harvesting of glial cells without contamination by neurons and connective tissue cells. Studying cultured glial cells does, however, have its pitfalls, as described by Wilkin and Marriott (pp. 67–68): "Liberating cells from the central nervous system into a culture dish might produce a situation in which the cells switch from normal to reactive phenotype." In fact nearly every chapter in *Astrocytes* contains a disclaimer to the effect that results obtained with cultured cells may not be relevant to "real life" in the brain.

Yet at least some of these results have been confirmed by observations of cells in their normal habitat, in intact brain tissue. Even if examined with appropriate caution, the evidence is impressive that astrocytes do more than help neurons stick together. At the very least they are crucial for "fine tuning the local environment [of neurons] in the brain" (Kimelberg *et al.*, p. 194). There are also good indications, for example, that astrocytes play an essential role in both the synthesis and the recycling of the neurotransmitter glutamic acid. Astrocytes also possess membrane receptors for a wide variety of other neurotransmitters and similar neuroactive substances. Activation of these glial receptors can trigger a number of cellular processes, indicating that astrocytes interact with neurons in numerous, as-yet-to-be-defined ways. Most remarkably, these electrically silent cells are equipped with membrane ion channels of both the voltage-gated and the ligand-gated variety. The significance of this finding remains unclear.

Readers who want to orient themselves in this rapidly advancing field will find what they need in this compact, well-written volume, although it is not an exhaustive review of neuroglia research. As is to be expected in a multiauthored compilation, not all of the contributions are equally up to date (some of the reference lists include papers from 1992, whereas others stop with 1991), and there is some overlap and redundancy among chapters. These are, however, minor flaws. The main ideas, the techniques, and the most important results of current glia research are all there, in easily digestible form.

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Crystallography Explained

Fundamentals of Crystallography. C. GIACOVAZZO, Ed. Oxford University Press, New York, 1992. xvi, 654 pp., illus. $125 or £65; paper, $65 or £27.50. International Union of Crystallography Texts on Crystallography, 2. Revision of *Introduzione alla Cristallografia Moderna*.

Crystallography is not only a pursuit in its own right, claiming the time and efforts of many experts; it is also basic to the pursuit of many other subjects. The ever-expanding capabilities of computers are opening new doors for those who make use of crystallography in their work. Intense and highly collimated forms of radiation from synchrotron sources make possible experiments that were out of the question only a decade ago. A wide range of scientists, from geologists to biologists, need access to information about the basics of crystallography as well as the exciting new methods that are now becoming available. Yet tracking down this information in diverse publications can be frustrating. Thus *Fundamentals of Crystallography* is a welcome contribution, bringing diverse information about crystallography under one cover where it can be easily found.

If you are looking for homey examples of symmetry or simplified explanations of diffraction, this is not the book for you. On the other hand, if you are seeking a book with a wide range of topics along with a high level of detail, you will not be disappointed. The reader with some background in crystallography will find that the book, although dense, is carefully organized, with a well-ordered structure and a high packing efficiency. Moreover, it has been completely revised and updated since its original publication in Italian in 1985. I think it makes a better reference book than textbook, although it could be useful in advanced courses.

A number of features make this volume particularly useful. First, it contains many attractive illustrations that do a good job in

clarifying the subject matter. Also, the authors are very diligent in defining terms: "point group" is carefully distinguished from "crystal class," "rotoinversion" from "rotoreflection," and so on. At first use important terms are set in bold type and defined. Unfortunately the writing is not always easy to follow; for instance, one is left wondering why more than one lattice point is included in some lattices. Nevertheless, the book is remarkably consistent in style and level despite having been written by seven authors.

I think that the most valuable aspect of the book is its emphasis on procedures, especially those involving the use of computers. Say, for instance, that you know of the Rietveld method and you suspect it might be useful to you in your work on a particular problem. In chapter 2 you will find detailed instructions on how to carry out Rietveld analyses.

Chapter 4 does a very nice job of discussing the older techniques such as the Debye Scherrer method along with the new ones such as the imaging plate, which provides two-dimensional patterns in digital form. Solution and refinement of crystal structures are covered very thoroughly in chapter 5 with details on several different approaches. Chapters 6 through 8 offer a comprehensive, logically developed discussion of crystal chemistry from bonding to proteins, accompanied by hundreds of well-drawn diagrams. The final chapter synthesizes much of this information with a discussion of the physical properties of crystals and the controls underlying them.

If you have any occasion to use crystallography in your work, you will find this book of value.

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Theoretical Physics

Quantum Field Theory. LOWELL S. BROWN. Cambridge University Press, New York, 1992. xiv, 542 pp., illus. $100 or £60.

Quantum field theory now comprises such a large number of topics that it is nearly impossible to present it adequately to the beginning student in a single volume. *Quantum Field Theory* by Lowell Brown comes close to accomplishing this feat. Marked by its astute choice of topics as well as by the clarity with which they are expounded, it is akin to a toolbox for students of modern quantum field theory.

The book begins with a quick review of quantum mechanics, followed by a detailed presentation of the Dirac-Feynman path integral, functional determinants, and coherent states. The next three chapters, the best in the book, are an excellent concise introduction to the basic techniques in nonrelativistic field theory and as such will benefit the student oriented toward condensed matter theory, who will find very pretty treatments of field theory at finite temperature, spontaneous symmetry breaking, and the role of the chemical potential. These discussions are presented in the context of the analysis of superfluid helium. A more conventional treatment of relativistic field theory follows, first using scalar theory and then quantum electrodynamics. Dimensional regularization is used throughout. I particularly enjoyed the sections on composite operators and on the operator product expansion. In chapter 6 the reader will find an excellent discussion of the Lehman representation of the propagator as well as a very thorough and rare treatment of unstable particles, including a detailed description of the deviations from the exponential decay law. The last chapter contains a detailed analysis of the quantum electrodynamic and infrared problem using dimensional regularization by way of a specific example and an equally thorough discussion of the Lamb shift, in which the same techniques are used. The imaginative problems at the end of each chapter serve to introduce concepts not treated in the main text. These exercises, designed to arouse the curiosity of the diligent student, constitute a valuable sub-book in their own right.

This is a very interesting and original textbook. Although, regrettably, it leaves many topics uncovered, for example non-Abelian gauge theories, it treats other subjects seldom mentioned in other texts. The style of presentation is crisp, and the book is sprinkled with the author's understated humor. The technical discussions are lucid, compact, and easy to follow, although they sometimes assume greater knowledge than might be expected from a student at this stage. However, any student who masters the techniques expounded here will emerge with a thorough knowledge of quantum field theory. I strongly recommend this book to whoever aspires to become either a particle or a condensed matter physicist.

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Books Received

Advances in Cardiovascular Engineering. Ned H. C. Hwang, Vincent T. Turitto, and Michael R. T. Yen, Eds. Plenum, New York, 1992. viii, 443 pp., illus. $115. NATO Advanced Science Institutes Series A, vol. 235. From an institute, Málaga, Spain, Dec. 1991.

American Ground Zero. The Secret Nuclear War. Carole Gallagher. MIT Press, Cambridge, MA, 1993. xxxiv, 427 pp., illus. $39.95.

Balinese Worlds. Fredrik Barth. University of Chicago Press, Chicago, 1993. x, 370 pp., illus. $55; paper, $19.95.

Chemistry in the Laboratory. A Study of Chemical and Physical Changes. J. A. Beran. Wiley, New York, 1993. xiv, 407 pp., illus. Paper, $40.95.

Dictionary of Biotechnology. James Coombs. 2nd ed. Stockton, New York, 1992. iv, 364 pp., illus. $90.

Economics. Joseph E. Stiglitz. Norton, New York, 1993. Variously paged, illus. $54.95.

Fire in the Brain. Ronald K. Siegel. Plume, New York, 1993. x, 275 pp. Paper, $10. Reprint, 1992 ed.

A Guide to Manual Materials Handling. A. Mital, A. S. Nicholson, and M. M. Ayoub. Taylor and Francis, Philadelphia, 1993. viii, 114 pp., illus. Paper, $25.

Handbook of the Birds of Europe, the Middle East, and North Africa. The Birds of the Western Palearctic. Vol. 6, Warblers. Stanley Cramp and Duncan J. Brooks, Eds. Oxford University Press, New York, 1992. vi, 728 pp., illus., + plates. $130.

Immunology of Pregnancy and Cancer. Valentin I. Govallo. Nova, Commack, NY, 1993. xiv, 310 pp., illus. $79. Translated from the Russian by Lena Jacobson.

The Lepidoptera. Form, Function and Diversity. Malcolm J. Scoble. Oxford University Press, New York, 1992. xii, 404 pp., illus. $78. Natural History Museum Publications.

Methods in Carbohydrate Chemistry. Vol. 9, Lipopolysaccharides, Separation and Analysis, Glycosylated Polymers. James N. BeMiller, Roy L. Whistler, and Derek H. Shaw, Eds. Wiley, New York, 1993.

New Developments in Fatty Acid Oxidation. Paul M. Coates and Kay Tanaka, Eds. Wiley-Liss, New York, 1992. xxiv, 595 pp., illus. $130. Progress in Clinical and Biological Research. From a symposium, Philadelphia, Nov. 1991.

Oncogene and Transgenics Correlates of Cancer Risk Assessments. Constantine Zervos, Ed. Plenum, New York, 1992. xii, 351 pp., illus. $110. NATO Advanced Science Institutes Series A, vol. 232. From a workshop, Attiki, Greece, Oct. 1991.

The Patterned Peatlands of Minnesota. H. E. Wright, Jr., Barbara A. Coffin, and Norman E. Aaseng, Eds. University of Minnesota Press, Minneapolis, 1992. xx, 327 pp., illus. $44.95.

Release of Genetically Engineered and Other Micro-organisms. J. C. Fry and M. J. Day, Eds. Cambridge University Press, New York, 1992. xvi, 178 pp., illus. $89.95. Plant and Microbial Biotechnology Research Series, 2.

Science, Politics and Morality. Scientific Uncertainty and Decision Making. René von Schomberg, Ed. Kluwer, Norwell, MA, 1993. xii, 235 pp. $86. Theory and Decision Library Series A, vol. 17. From a workshop, June 1991.

Treatise on Analytical Chemistry. Part 1, Thermal Methods, vol. 13. James D. Winefordner *et al.*, Eds. 2nd ed. Wiley, New York, 1993. xx, 406 pp., illus. $95.

Understanding Genetics. A Molecular Approach. Norman V. Rothwell. Wiley-Liss, New York, 1993. xvi, 656 pp., illus. $48.

The Variational Principles of Dynamics. Boris A. Kupershmidt. World Scientific, River Edge, NJ, 1992. xviii, 422 pp. $46. Advanced Series in Mathematical Physics, vol. 13.

Visions of Caliban. On Chimpanzees and People. Dale Peterson and Jane Goodall. Houghton Mifflin, Boston, MA, 1993. xii, 367 pp. + plates. $22.95.

William Henry Welch and the Heroic Age of American Medicine. Simon Flexner and James Thomas Flexner. Johns Hopkins University Press, Baltimore, MD, 1993. xiv, 539 pp. + plates. $29.95. Reprint, 1941 ed.

Women and the Use of Military Force. Ruth H. Howes and Michael R. Stevenson, Eds. Rienner, Boulder, CO, 1993. viii, 247 pp. $38.

World Forests for the Future. Their Use and Conservation. Kilaparti Ramakrishna and George M. Woodwell, Eds. Yale University Press, New Haven, CT, 1993. xx, 156 pp., illus. $18.50. From a workshop, Woods Hole, MA.