international literature and who can only rarely attend meetings in the West, though some of the Kiev group often report their work in English-language gerontological publications. The extensive bibliography contains sources that are not widely known, including special publications of the Institute of Gerontology. Russian titles are helpfully translated into English. The bibliography shows an energetic attention to the English and Romance-language gerontological literature that is far more conscientious than most of us give to the Slavic scientific literature.

Several of the many topics covered in the book are notable. Chapter 1 briefly mentions the effects of age on the electrical activities of snail neurons; this work was subsequently reported more fully by Frolkis in *Mechanisms of Ageing and Development* **25**, 191 (1984). Age changes in the control of aldosterone and in hypothalamic influences on the adrenal cortex have been studied by L. V. Magdich and are discussed by Frolkis and E. N. Gorban (chapter 2). Solid work on immunological changes with age is described by G. M. Butenko (chapter 3), who studied parabiosis and the grafting of spleen cells between animals of different ages in a strain of CBA mice. Butenko's studies are particularly appealing because they go beyond the descriptive observation of many of the geronotological studies in the U.S.S.R. in their attempt to establish mechanisms by manipulating specific aspects of aging. In the interest of corroborating results it is helpful that a relative of the widely used CBA mouse is available in the U.S.S.R.

A recurrent theoretical motif is Frolkis's general interpretation of age-related changes as resulting from two opposing processes, destructive aspects of aging that are countered by *vitauct*, or life-prolonging processes, such as axoplasmic flow, cell division, or detoxification. The attention given to such general concepts here and occasionally elsewhere in the Russian literature suggests a propensity to formulate general theories that may not be testable in detail. Most scientists prefer to focus on specific hypotheses, since it is so difficult to make robustly generalizable biological theories.

In addition to the group in Kiev, other experimentalists who study biological and medical aspects of aging are cited in the book. V. M. Dilman and V. N. Anisimov at the Petrov Institute for Oncology (Leningrad) have made many important contributions, including detailed predictive hypotheses about neuroendocrine mechanisms in aging and in oncogenesis. No reference is made in the book to Zh. Medvedev's pioneering contributions, especially the error theory of aging, which, in 1961, first focused attention on the potential importance of altered information flow from the genome.

In sum, the present volume can be regarded as a valuable entry to a literature that is often neglected. The volume furthers the long-range maintenance of international scientific contact by increasing our awareness of Soviet colleagues with kindred scientific pursuits.

CALEB E. FINCH
Andrus Gerontology Center and
Department of Biological Sciences, University of Southern California, Los Angeles 90089-0191

Spinor Calculus

Spinors and Space-Time. Vol. 1, Two-Spinor Calculus and Relativistic Fields. ROGER PENROSE and WOLFGANG RINDLER. Cambridge University Press, New York, 1984. x, 458 pp., illus. $89.50. Cambridge Monographs on Mathematical Physics.

Most discussions of special or general relativity use the mathematical machinery provided by tensor calculus. However, over the past 25 years it has become increasingly clear that there is an alternative to tensor calculus that often simplifies calculations and is, in a certain sense, more fundamental. This is the calculus of two-component spinors. Until now, a student wishing to learn spinor calculus had to turn to dozens of original papers and struggle with incomplete results and different conventions. *Spinors and Space-Time*, to be published in two volumes, provides for the first time a systematic and complete discussion of the properties and applications of two-component spinors. It is a long-awaited and much-needed work.

Volume 1 makes it clear that the work is not just for the beginning student. In addition to its excellent presentation of established material, it is filled with new insights, simple arguments, and general formulas that will benefit even the expert in the field.

The volume begins by introducing spinors geometrically in terms of "null flags." The three basic spinor operations—addition, scalar multiplication, and inner product—are all given explicit geometric interpretations. The introduction discusses many interesting properties of the Lorentz group such as that (as was first pointed out by Penrose) a uniformly moving sphere will appear rotated and not flattened, as a naïve application of the Lorentz contraction might suggest. Of particular note are the figures, which beautifully illustrate the text and help the reader to visualize the various geometric constructions.

The authors then move on to a more abstract algebraic approach to spinors that forms the basis for the rest of the book. That the space of spinors is a complex two-dimensional vector space leads to a number of special properties, which are discussed in detail. In keeping with the algebraic approach, traditional differential geometry is presented in a slightly untraditional way, for example by defining a manifold in terms of its ring of smooth functions. Derivatives of spinors and spinor curvature are discussed from both a basis-independent and a basis-dependent point of view—the latter approach leading to the Newman-Penrose spin coefficient formalism. One of the less familiar topics discussed in the book is a method for translating an arbitrary spinor equation into tensor language. For example, it is shown that the linear Weyl neutrino equation is equivalent to a nonlinear equation on an antisymmetric second-rank tensor.

The main application of spinors that is discussed in volume 1 is to relativistic fields. Spinors provide a simple unified treatment of massless fields of arbitrary spin. The conformal properties and consistency conditions (which arise in curved space) for these fields is examined. Of particular importance are the discussion of initial data on null surfaces and the explicit formulas for the field in terms of integrals over its initial data. An approach to interacting fields that is based on these results is also discussed. Further applications of spinors, including their use in asymptotically flat spacetimes to prove the peeling theorem for radiation and the positive energy theorem, will be given in volume 2.

Volume 1 develops and uses extensively the abstract index notation that was introduced by Penrose to provide a basis-independent notation that would facilitate calculations. Although abstract indices are certainly quite useful, they are perhaps overemphasized in this book. There are over a dozen different symbols used for indices, and a great deal of time is spent explaining the notation. This emphasis on notation tends to detract from the subject matter and make the otherwise clear exposition somewhat difficult to read. Unfortunately, the situation is complicated by the fact that the printing does not enable one to easily distinguish certain types of indices. One hopes that this last problem will be cor-

rected in the second printing of the book.

Despite these notational difficulties, I would strongly recommend volume 1 of *Spinors and Space-Time*. Its careful and comprehensive discussion virtually assures that it will become a standard reference in the field.

GARY HOROWITZ

Department of Physics,
University of California,
Santa Barbara 93106

Reprints of Books Previously Reviewed

Likelihood. A. W. F. Edwards. Cambridge University Press, New York, 1985. Paper, $16.95. Cambridge Science Classics. *Reviewed* **177**, 878 (1972).

Niels Bohr. The Man, His Science, and the World They Changed. Ruth Moore. MIT Press, Cambridge, Mass., 1985. Paper, $9.95. *Reviewed* **155**, 549 (1967).

Theory and Experiment in Gravitational Physics. Clifford M. Will. Cambridge University Press, New York, 1985. Paper, $24.95. *Reviewed* **216**, 978 (1982).

The Very Early Universe. G. W. Gibbons, S. W. Hawking, and S. T. C. Siklos, Eds. Cambridge University Press, New York, 1985. Paper, $24.95. *Reviewed* **224**, 863 (1984).

Books Received

Acid Rain. Steve Elsworth. Pluto Press, Dover, N.H., 1984. vi, 154 pp. Paper, $5.95.

Acquired Hearing Loss. Psychological and Psychosocial Implications. Alan J. Thomas. Academic Press, Orlando, Fla., 1985. x, 215 pp. $40.

Advances in Geodesy. Erik W. Grafarend and Richard H. Rapp, Eds. American Geophysical Union, Washington, D.C., 1984. vi, 310 pp., illus. Paper, $23. Reprinted from *Reviews of Geophysics and Space Physics*.

Advances in Myocardiology. Vol. 6. N. S. Dhalla and D. J. Hearse, Eds. Plenum, New York, 1985. xiv, 669 pp., illus. $79.50. From a congress, London, July 1983.

Advances in Nephrology and Dialysis. G. D'Amico and G. Colasanti, Eds. Karger, Basel, 1985. x, 213 pp., illus. $78. Contributions to Nephrology, vol. 45. From a course, Milan, Dec. 1983.

Advances in Neuroblastoma Research. Audrey E. Evans, Giulio J. D'Angio, and Robert C. Seeger, Eds. Liss, New York, 1985. xxvi, 605 pp., illus. $78. Progress in Clinical and Biological Research, vol. 175. From a symposium, Philadelphia, May 1984.

Affluence and Cultural Survival. Richard F. Salisbury and Elisabeth Tooker, Eds. American Ethnological Society, Washington, D.C., 1985. vi, 171 pp. Paper, $14. The 1981 Proceedings of the American Ethnological Society.

The Amphibian Ear. Ernest Glen Wever. Princeton University Press, Princeton, N.J., 1985. viii, 488 pp., illus. $65.

Análisis de la Conducta Verbal. Un Método para Cuantificar Atributos Psicológicos. Louis A. Gottschalk *et al*. Editorial Universitaria, Santiago, Chile, 1984. 227 pp. Paper, $10. Abridged and translated from the English edition (Berkeley, 1969).

Analogue and Digital Electronics for Engineers. An Introduction. H. Ahmed and P. J. Spreadbury. Cambridge University Press, New York, 1984. xiv, 289 pp., illus. $39.50; paper, $18.95. Second edition of *Electronics for Engineers*.

Ancestral Voices. Language and the Evolution of Human Consciousness. Curtis G. Smith. Illustrations by Katherine A. Dorfman. Prenctice-Hall, Englewood Cliffs, N.J., 1985. xiv, 178 pp. $15.95; paper, $9.95. Frontiers of Science.

Angiographic Anatomy of the Anterior Inferior Cerebellar Artery. Jan J. Heimans, Jaap Valk, and Anthony H. M. Lohman. Springer-Verlag, New York, 1985. viii, 93 pp., illus. Paper, $23. Advances in Anatomy, Embryology and Cell Biology, vol. 92.

Animal Models in Psychopathology. Nigel W. Bond, Ed. Academic Press, Orlando, Fla., 1984. xii, 318 pp., illus. $29.

Annual Review of Neuroscience. Vol. 8. W. Maxwell Cowan *et al.*, Eds. Annual Reviews, Palo Alto, Calif., 1985. viii, 603 pp., illus. $27.

The Antarctic Circumpolar Ocean. George Deacon. Cambridge University Press, New York, 1985. viii, 180 pp., illus. $24.95. Studies in Polar Research.

The Astronomical Scrapbook. Skywatchers, Pioneers, and Seekers in Astronomy. Joseph Ashbrook. Leif J. Robinson, Ed. Cambridge University Press, New York, and Sky Publishing, Cambridge, Mass., 1985. xii, 468 pp., illus. $19.95.

Atlantic Hydrophysical Polygon-70. Meteorological and Hydrophysical Investigations. V. G. Kort and V. S. Samoilenko, Eds. Balkema, Rotterdam, 1984. viii, 398 pp., illus. $25. Russian Translations Series, 11. Translated from the Russian edition (Moscow, 1974).

Basic Biochemical Methods. Renee R. Alexander, Joan M. Griffiths, and Maria L. Wilkinson. Wiley-Interscience, New York, 1985. xiv, 241 pp., illus. Spiral bound, $24.95.

Basic Concepts in Teratology. T. V. N. Persaud, A. E. Chudley, and R. G. Skalko. Liss, New York, 1985. x, 190 pp., illus. $38.

The Beginnings of Electron Microscopy. Peter W. Hawkes, Ed. Academic Press, Orlando, Fla., 1985. xx, 633 pp., illus. $88. Advances in Electronics and Electron Physics, Supplement 16.

Big Structures, Large Processes, Huge Comparisons. Charles Tilly. Russell Sage Foundation, New York, 1984 (distributor, Basic Books, New York). xii, 176 pp. $14.50. 75th Anniversary Series.

Biotechnology and Genetic Engineering Reviews. Vol. 2. Gordon E. Russell, Ed. Intercept, Newcastle upon Tyne, England, 1984. x, 468 pp., illus. $79.

Brain Mechanisms of Sleep. Dennis J. McGinty *et al*., Eds. Raven, New York, 1985. xx, 436 pp., illus. $61.50. From a symposium, Bologna, Italy, July 1983.

Brain and Psyche. The Biology of the Unconscious. Jonathan Winson. Anchor/Doubleday, Garden City, N.Y., 1985. xii, 300 pp., illus. $16.95.

Brines and Evaporites. Peter Sonnenfeld. Academic Press, Orlando, Fla., 1984. xx, 613 pp., illus. $75.

Cardiocirculatory Function in Renal Disease. H. Jahn *et al*., Eds. Karger, Basel, 1984. xii, 459 pp., illus. $98.25. Contributions to Nephrology, vol. 41. From a workshop, Strasbourg, Sept. 1983.

Carnivorous Plants. Adrian Slack. Photographs by Jane Gate, MIT Press, Cambridge, Mass., 1985. 240 pp. Paper, $12.50. Reprint, 1980 edition.

Les Catastrophes de la Parole de Roman Jakobson à René Thom. Jean Petitot-Cocorda. Maloine, Paris, 1985. 355 pp., illus. Paper, 140 F. Collection Recherches Interdisciplinaires Dirigée par Pierre Delattre.

CERN Accelerator School: Antiprotons for Colliding Beam Facilities. (Geneva, Oct. 1983). P. Bryant and S. Newman, Ed. CERN, Geneva, 1984. xii, 555 pp., illus. Paper. CERN 84-15.

Chimeras in Developmental Biology. Nicole Le Douarin and Anne McLaren, Eds. Academic Press, Orlando, Fla., 1984. xiv, 456 pp., illus. $78.

Chitin, Chitosan, and Related Enzymes. John P. Zikakis, Ed. Academic Press, Orlando, Fla., 1984. xxiv, 423 pp., illus. $39.50. From a seminar, Newark, Del., April 1984.

Chloroplast Metabolism. The Structure and Function of Chloroplasts in Green Leaf Cells. Barry Halliwell. 2nd ed. Clarendon (Oxford University Press), New York, 1984. xii, 259 pp., illus. Paper, $15.95.

Classical General Relativity. W. B. Bonnor, J. N. Islam, and M. A. H. MacCallum, Eds. Cambridge University Press, New York, 1984. xvi, 269 pp., illus. $44.50. From a conference, London, Dec. 1983.

Clinical Applications of Ribavirin. Roberts A. Smith, Vernon Knight, and James A. D. Smith, Eds. Academic Press, Orlando, Fla., 1984. xxii, 222 pp., illus. $27.50. From a symposium, Newport Beach, Calif., Sept. 1983.

Clinical Neuropsychology. Kenneth M. Heilman and Edward Valenstein, Eds. 2nd ed. Oxford University Press, New York, 1985. xvi, 540 pp., illus. $35.

Cold Plasma Waves. Henry G. Booker. Nijhoff, Dordrecht, Netherlands, 1984 (U.S. distributor, Kluwer, Hingham, Mass.). xvi, 349 pp., illus. $59.50. Developments in Electromagnetic Theory and Applications, 2.

Collectivisation, Convergence and Capitalism. Political Economy in a Divided World. Michael Ellman. Academic Press, Orlando, Fla., 1984. xii, 332 pp. $55. Studies in Political Economy.

Colloidal Phenomena. Advanced Topics. C. S. Hirtzel and Raj Rajagopalan. Noyes, Park Ridge, N.J., 1985. xvi, 318 pp., illus. $36.

Compartmental Analysis. Medical Applications and Theoretical Background. Fumihiko Kajiya *et al*., Eds. Karger, Basel, 1984. x, 190 pp., illus. $79.25.

Computing in Accelerator Design and Operation. W. Busse and R. Zelazny, Eds. Springer-Verlag, New York, 1984. xii, 574 pp., illus. Paper, $28. Lecture Notes in Physics, vol. 215. From a conference, Berlin, Sept. 1983.

Condensed Matter Research Using Neutrons. Today and Tomorrow. Stephen W. Lovesey and Reinhard Scherm, Eds. Plenum, New York, 1984. viii, 329 pp., illus. $45. NATO ASI Series B, vol. 112. From a workshop, Abingdon, U.K., March 1984.

Conodont Biofacies and Provincialism. David L. Clark, Ed. Geological Society of America, Boulder, Colo., 1984. vi, 340 pp., illus. Paper, $36. Geological Society of America Special Paper 196. From a symposium, April 1983.

The Ecology and Physiology of the Fungal Mycelium. D. H. Jennings and A. D. M. Rayner, Eds. Cambridge University Press, New York, 1984. xvi, 564 pp., illus. $99.50. British Mycological Society Symposium 8. From a symposium, Bath, England, April 1983.

The Ecology of Tropical Food Crops. M. J. T. Norman, C. J. Pearson, and P. G. E. Searle. Cambridge University Press, New York, 1984. x, 369 pp., illus. $59.50; paper, $24.95.

Economic Structure and Performance. Essays in Honor of Hollis B. Chenery. Moshe Syrquin, Lance Taylor, and Larry E. Westphal, Eds. Academic Press, Orlando, Fla., 1984. xxvi, 584 pp., illus. $79.50.

Edible Aroids. S. Chandra, Ed. Clarendon (Oxford University Press), New York, 1984. xviii, 252 pp., illus. $34.95.

Effects of Chemical Warfare. A Selective Review and Bibliography of British State Papers. Andy Thomas. SIPRI, Solna, Sweden, and Taylor and Francis, Philadelphia, 1985. viii, 125 pp., illus. Paper, $18. SIPRI Chemical and Biological Warfare Studies, 1.

Elements of Dynamic Oceanography. David Tolmazin. Allen and Unwin, Boston, 1985. xiv, 181 pp., illus. $35; paper, $19.95.

Eleventh International Seaweed Symposium. (Qingdao, China, June 1983.) Carolyn J. Bird and Mark A. Ragan, Eds. Junk, Dordrecht, Netherlands, 1984 (U.S. distributor, Kluwer, Hingham, Mass.). xxxii, 624 pp., illus. $128.50. Developments in Hydrobiology 22. Reprinted from *Hydrobiologia*, vol. 116/117.

End Points for Cardiovascular Drug Studies. Ruth Johnsson Hegyeli, Ed. Raven, New York, 1984. xiv, 200 pp., illus. $49.50. Atherosclerosis Reviews, vol. 12. From a symposium, Rome, June 1983.

Energetics and Transport in Aquatic Plants. John A. Raven. Liss, New York, 1984. x, 587 pp., illus. $88. MBL Lectures in Biology, vol. 4.

Energy and Development in Southern Africa. SADCC Country Studies. Phil O'Keefe and Barry Munslow, Eds. Beijer Institute (Royal Swedish Academy of Sciences), Stockholm, and Scandinavian Institute of African Studies, Uppsala, Sweden, 1984. Part 1. viii, 193 pp. SEK 75. Part 2. xii, 227 pp. SEK 75. Energy, Environment and Development in Africa, 3 and 4.

Energy Around the World. An Introduction to Energy Studies: Global Resources, Needs, Utilization. J. C. McVeigh. Pergamon, New York, 1984. xiv, 253 pp., illus. Paper, $10.95.

Energy Transfer Processes in Condensed Matter. Baladassare Di Bartolo and Aliki Karipidou, Eds. Plenum, New York, 1984. xxviii, 696 pp., illus. $105. NATO ASI Series B, vol. 114. From an institute, Erice, Sicily, June 1983.

The Enigma of Probability and Physics. Lazar Mayants. Reidel, Boston, 1984 (distributor, Kluwer, Hingham, Mass.). xx, 373 pp. $69. Fundamental Theories of Physics.

Environmental Biology of Darters. David G. Lindquist and Lawrence M. Page, Eds. Junk, Dordrecht, 1984 (U.S. distributor, Kluwer, Hingham, Mass.). 127 pp., illus. $44. Developments in Environmental Biology of Fishes 4. Reprinted from *Environmental Biology of Fishes*, vol. 11, No. 2. From a symposium, DeKalb, Ill., June 1982.

Environmental Geochemistry. M. E. Fleet, Ed. Mineralogical Association of Canada, Toronto, 1984. x, 306 pp., illus. Paper. Short Course Handbook, vol. 10. From a meeting, London, Ontario, Canada, May 1984.

Environmental Physiology and Biochemistry of Insects. Klaus H. Hoffmann, Ed. Springer-Verlag, New York, 1985. x, 296 pp., illus. $34.50.

Enzyme Engineering 7. A. I. Laskin, G. T. Tsao, and L. B. Wingard, Jr., Eds. New York Academy of Sciences, New York, 1984. xviii, 596 pp., illus. Paper, $135. Annals of the New York Academy of Sciences, vol. 434. From a conference, White Haven, Pa., Sept. 1983.

The Epidemiology of Severe Intellectual Impairment. The Dynamics of Prevalence. Tom Fryers.

(Continued on page 1456)