

Star formation rates and the related topic of chemical evolution are discussed by B. F. Madore and B. E. J. Pagel, respectively. Both reviews end on a cautious note because of the uncertainty about many aspects of these topics.

Radio and x-radiation are common properties of peculiar galaxies, objects outside the scope of this conference. But many normal galaxies display such phenomena on a reduced scale. R. D. Ekers discusses the radio continuum emission from normal galaxies and A. C. Fabian the x-rays from these systems and from clusters of galaxies.

The usefulness of these proceedings is enhanced by two indexes, one general and one of individual objects. A brief glossary of some of the jargon and abbreviations common to this topic is also included.

MORTON S. ROBERTS

*National Radio Astronomy
Observatory,
Charlottesville, Virginia 22901*

Cognitive Science

Perspectives on Cognitive Science. Papers from a meeting, La Jolla, Calif., Aug. 1979. DONALD A. NORMAN, Ed. Ablex, Norwood, N.J., and Erlbaum, Hillsdale, N.J., 1981. x, 304 pp. \$19.95.

Scientific progress usually leads to fragmentation and to a proliferation of subspecies. It is a rare but important occasion, therefore, when events reverse that trend, when specialists discover unexpected bonds between their specialties and join together in a common enterprise.

Such are the claims for the young field of cognitive science, which promises to integrate those parts of psychology, computer science, linguistics, neuroscience, anthropology, and philosophy that are dedicated to understanding the phenomena of cognition. Obviously, a clear statement of the shared problems, goals, methods, and theories underlying this integration would be enormously valuable to all concerned, so in August 1979 in La Jolla, California, an attempt was made to provide it.

"It was to be the 'defining meeting,' the meeting where many of those concerned with the birth of Cognitive Science could record its origins, speak of its hopes, and chart its course" (p. v). So writes Donald Norman in his prefatory description of the plans that brought together 11 eminent cognitive scientists. This book is the result.

However, the book turns out to be not so much defining as illustrative. And although the editor claims that it provides ten perspectives on cognitive science, "each viewing a different set of topics, each presented in a different style" (p. vi), there are really only two: one view favoring information-processing theories of cognition, the other objecting to them. Not surprisingly, those who agree offer a more coherent perspective than do those who object.

This contrast of views might have been predicted from the list of participants. Five of the contributors work in the branch of computer science that has come to be called artificial intelligence (A.I.); the other five represent neurobiology, psychology, linguistics, philosophy—disciplines not noted for seeing eye-to-eye about anything.

The conference was opened by Herbert A. Simon, who commented, "I think that most of us today would prefer to define cognitive science as the domain of inquiry that seeks to understand intelligent systems and the nature of intelligence" (p. 14). Obviously, Simon sees no need to distinguish cognitive science from A.I. Simon's colleague, Allen Newell, explains how the core of intelligence is provided by symbol structures and their manipulation. "The great news," Newell says, is that we now know "how it is possible for mind to exist in this physical universe" (p. 84). Together, Simon and Newell summarize what might be called the standard theory of cognition at the present time—the theory that serves as the point of origin for a space of theoretical alternatives, the theory that provides a landmark relative to which other views can be located. Compared with the theories available 25 years ago, the standard theory is clearly an impressive advance.

Marvin Minsky, another founding father of A.I., is less concerned to define cognitive science than to present his latest ideas about the nature and function of memory. Roger Schank illustrates how he has used computer programming to help him understand the role of memory in understanding language. Terry Winograd describes the gradual evolution of his own understanding of what it means to say that a person or a computer understands language: "The importance of a paradigm may not lie so much in the answers it provides as in the questions it leads one to consider" (p. 261). All three struggle toward basic redefinitions of the standard view, but redefinitions that preserve the insights gained from the standard theory that cognition is information processing.

These are distinguished scientists, whose chapters offer fascinating insights into current thinking in A.I. The other contributors are equally distinguished, but far more diverse. Their contributions will be read with interest by colleagues in their own disciplines, but they do not add up to a coherent alternative to the standard theory. Either the authors describe their own on-going work or they accept the standard theory as the criterion of relevance and try to relate their remarks to that. The former strategy leads to heterogeneity, the latter invites misunderstanding or trivialization.

The reader is left wondering what cognitive science really is. Is it a new science, synthesizing from half a dozen different disciplines those parts concerned with mental phenomena? Or is it merely a new name for artificial intelligence? A branch of A.I., perhaps, on a par with robotics or automata theory? The rhetoric of this book suggests the former view; its contents suggests the latter.

Those who believe the rhetoric (and some do feel that A.I. is trying to kidnap cognitive science) will not be satisfied with the general picture that emerges from this book. Their attempts to revise that picture can be expected to stir up much of the intellectual excitement in this field in the next few years.

GEORGE A. MILLER

*Department of Psychology,
Princeton University,
Princeton, New Jersey 08544*

Plastids

Chloroplasts. J. REINERT, Ed. Springer-Verlag, New York, 1980. xxi, 240 pp., illus. \$46. Results and Problems in Cell Differentiation, vol. 10.

Plastids may be considered the fundamental organelles of the living world, since they contain apparatus essential for the trapping of light energy and its conversion to chemical energy. In higher plants chloroplasts may account for over 50 percent of the soluble protein of leaves and store starch as a major carbohydrate. Plastids are not confined to terrestrial plants but also occur in aquatic plants, where they have developed specialized pigments to trap light from spectra attenuated by passage through water. In other circumstances they have also adapted to their immediate environment to become starch storage organelles (amyloplasts), to develop pigments other than the chlorophylls that confer

color to many fruits and flowers (chromoplasts), or to lose pigments (leucoplasts).

As well as being the site of photosynthesis, plastids contain their own DNA and unique prokaryotic-type (70S) ribosomes, a fact that has lent support to the idea that they may be autonomous organelles that are perhaps symbiotic in their relationship to the cells they inhabit. Thus recent research on plastids has been directed toward an understanding of their biology and molecular biology as organelles, whereas earlier studies were limited to describing the physiological function of plastids only in terms of photosynthesis. Our changing thoughts about plastids are reflected in *Chloroplasts*, which is really about plastids.

The volume comprises eight chapters that, in effect, are essays from authors active in their fields. It makes no attempt to cover all aspects of research on chloroplasts, and, refreshingly, some essays represent the subjective views of their authors rather than the dull litany of objectivity many reviewers have adopted in recent times. Plastids are viewed as organelles, as might be expected from a volume in a series on "results and problems in cell differentiation." The first chapter deals comprehensively, but succinctly, with the structural diversity of plastids and highlights their remarkable resiliency, exemplified by an ability to convert to various forms depending upon changing cellular environment. Just as remarkable are the factors controlling the continuity and conservation of plastids from cell to cell and the ways in which the division of cells and plastids is coordinated, particularly in some cases of extreme genetic perturbation. The semiautonomous nature of plastids may provide an explanation for their resiliency and stability, for no qualitative changes in plastid DNA accompany physiological changes, a fact suggesting that the stability resides in the plastid genome. The longest chapter in the book is devoted to plastid DNA. Endonuclease techniques are providing maps of the circular DNA, and studies have shown the nuclear coding of the small subunit of the major soluble chloroplast protein, fraction I, and the plastid DNA coding of the large subunit. Evidence for the collaboration of the two genomes is further developed in a chapter on RNA and protein synthesis in plastid differentiation. Thus this volume succeeds in highlighting the plastid as an organelle and describes the complex interaction between it and plant cells. Yet though chloroplasts have been shown to be capable of surviving in artificial media the

final chapter rightly concludes that any successful culture system will have to include purified macromolecules and cellular membrane components and possibly other organelles in addition to the plastids.

D. J. GOODCHILD

*Division of Plant Industry,
Commonwealth Scientific and
Industrial Research Organisation,
Canberra A.C.T. 2601, Australia*

Books Received

Aboriginal Man Adapting. The Human Biology of Australian Aborigines. R. L. Kirk. Clarendon (Oxford University Press), New York, 1981. xii, 230 pp., illus. \$59. Research Monographs on Human Population Biology.

Ada: An Introduction. Henry Ledgard. *Ada Reference Manual (July 1980)*. Springer-Verlag, New York, 1981. Variously pagged. Paper, \$12.95.

Biological Monitoring of Marine Pollutants. Proceedings of a symposium, Milford, Conn., Nov. 1980. F. John Vernberg, Anthony Calbrese, Frederick P. Thurberg, and Winona B. Vernberg, Eds. Academic Press, New York, 1981. xiv, 560 pp., illus. \$34.

Biology of Conidial Fungi. Vol. 2, Garry T. Cole and Bryce Kendrick, Eds. Academic Press, New York, 1981. xx, 660 pp., illus. \$68.50.

Coping with the Common Cold. Wendy Murphy. Time-Life Books, Alexandria, Va., 1981. 176 pp., illus. \$11.95. Library of Health.

Darwin on Man. A Psychological Study of Scientific Creativity. Howard E. Gruber. University of Chicago Press, Chicago, ed. 2, 1981. xxviii, 310 pp., illus. Cloth, \$25; paper, \$7.95.

Diabetes. The GLUCOGRAF™ Method for Normalizing Blood Sugar. Richard K. Bernstein. Crown, New York, 1981. xx, 298 pp., \$14.95.

Environmental Factors in Mammal Reproduction. Desmond Gilmore and Brian Cook, Eds. University Park Press, Baltimore, 1981. x, 330 pp., illus. \$44.50. Biology and Environment.

Environmental Protest and Citizen Politics in Japan. Margaret A. McKean. University of California Press, Berkeley, 1981. xvi, 292 pp., \$28.50.

Enzymes as Drugs. John S. Holcenberg and Joseph Roberts, Eds. Wiley-Interscience, New York, 1981. viii, 456 pp., illus. \$59.50.

How to Plan, Design and Implement a Bad System. Ronald B. Smith. Petrocelli, Princeton, N.J., 1981 (trade distributor, Van Nostrand Reinhold, New York). x, 158 pp., \$14.

Human Adaptability. An Introduction to Ecological Anthropology. Emilio F. Moran. Duxbury, North Scituate, Mass., 1979. xii, 404 pp., illus. \$13.95. Duxbury Press Series in Anthropology.

Mechanics and Wave Forces on Offshore Structures. Turgut Sarpkaya and Michael Isaacson. Van Nostrand Reinhold, New York, 1981. xvi, 652 pp., illus. \$37.50.

Medical Consequences of Alcohol Abuse. P. M. S. Clark and L. J. Kricka. Horwood, Chichester, England, and Halsted (Wiley), New York, 1980. 282 pp., \$97.95. Ellis Horwood Series in Chemical Science.

Methods in Vitamin B-6 Nutrition. Analysis and Status Assessment. Proceedings of a workshop, Mt. Hood, Ore., June 1980. James E. Leklem and Robert D. Reynolds, Eds. Plenum, New York, 1981. xii, 402 pp., illus. \$49.50.

Mode of Action of Herbicides. Floyd D. Ashton and Alden S. Crafts. Wiley-Interscience, New York, ed. 2, 1981. x, 526 pp., illus. \$42.50.

Neuroreceptors. Basic and Clinical Aspects. Papers from a meeting, Dec. 1979. Earl Usdin, William E. Bunney, Jr., and John M. Davis, Eds. Wiley-Interscience, New York, 1981. xii, 280 pp., illus. \$60.50.

Nitrogen and Carbon Metabolism. Proceedings of a symposium, Calgary, Canada, July 1980. J. Derek Bewley, Ed. Nijhoff/Junk, The Hague, 1981 (U.S. distributor, Kluwer Boston, Hingham, Mass.). viii, 248 pp., illus. \$39.50. Developments in Plants and Soil Sciences, vol. 3.

Nucleic Acids and Proteins. Proceedings of a symposium, Shanghai, Oct. 1979. Shen Zhao-wen, Ed. Science Press, Beijing, China, 1980 (U.S. distributor, Van Nostrand Reinhold, New York). xiv, 662 pp., illus. \$42.

Nutrition and Cancer. Etiology and Treatment.

Guy R. Newell and Neil M. Ellison, Eds. Raven, New York, 1981. xiv, 446 pp., illus. \$49.50. Progress in Cancer Research and Therapy, vol. 17.

Optical Fiber Systems and Their Components. An Introduction. A. B. Sharma, S. J. Halme, and M. M. Butusov. Springer-Verlag, New York, 1981. viii, 248 pp., illus. \$38.35. Springer Series in Optical Sciences, 24.

Paleoecology. Concepts and Applications. J. Robert Dodd and Robert J. Stanton, Jr. Wiley-Interscience, New York, 1981. xvi, 560 pp., illus. \$39.95.

Paranormal Borderlands of Science. Kendrick Frazier, Ed. Prometheus, Buffalo, N.Y., 1981. xiv, 470 pp., illus. Paper, \$12.95.

Proceedings of the Conference on Subretinal Space. Jerusalem, Oct. 1979. H. Zauberman, Ed. Junk, The Hague, 1981 (U.S. distributor, Kluwer Boston, Hingham, Mass.). x, 306 pp., illus. \$71. Documenta Ophthalmologica Proceedings Series, vol. 25.

Proceedings of the Exxon Engineering Symposium 1980. Barry Tarmy, Ed. Exxon Research and Engineering Company, Florham Park, N.J., 1981. xvi, 128 pp., illus. Cloth.

Proceedings of the International Symposium on Atomic, Molecular, and Solid-State Theory, Collision Phenomena, Quantum Statistics, and Computational Methods. Flagler Beach, Fla., Mar. 1980. Per-Olov Löwdin and Yngve Öhrn, Eds. Interscience (Wiley), New York, 1981. xx, 734 pp., illus. \$40. *International Journal of Quantum Chemistry*. Quantum Chemistry Symposium No. 14.

Proceedings of the International Symposium on Quantum Biology and Quantum Pharmacology. Palm Coast, Fla., Mar. 1980. Per-Olov Löwdin and John R. Sabin, Eds. Interscience (Wiley), New York, 1981. xii, 438 pp., illus. Paper, \$70. *International Journal of Quantum Chemistry*. Quantum Biology Symposium No. 7.

Progress in Physical Organic Chemistry. Vol. 13. Robert W. Taft, Ed. Interscience (Wiley), New York, 1981. xii, 638 pp., illus. \$75.

Projection Methods in Constrained Optimisation and Applications to Optimal Policy Decisions. Berc Rustem. Springer-Verlag, New York, 1981. xvi, 316 pp. Paper, \$17.40. Lecture Notes in Control and Information Sciences, vol. 31.

Radiation Protection. A Guide for Scientists and Physicians. Jacob Shapiro. Harvard University Press, Cambridge, Mass., ed. 2, 1981. xxiv, 480 pp., illus. \$25.

Rapid and Automated Methods in Microbiology and Immunology. A Bibliography 1976-1980. Wendy J. Palmer, Ed. Information Retrieval, Washington, D.C., 1981. viii, 266 pp. Paper, \$36.

Readings in Philosophy of Psychology. Vol. 2. Ned Block, Ed. Harvard University Press, Cambridge, Mass., 1981. viii, 366 pp. \$22.50. The Language and Thought Series.

A Sierra Club Naturalist's Guide to the North Atlantic Coast. Cape Cod to Newfoundland. Michael and Deborah Berrill. Illustrations by Rob Tuckerman. Sierra Club Books, San Francisco, 1981 (trade distributor, Scribner, New York). x, 464 pp. + plates. Cloth, \$24.95; paper, \$10.95.

Spoken Language Generation and Understanding. Proceedings of an institute, Bonas, France, June 1979. J. C. Simon, Ed. Reidel, Boston, 1981 (distributor, Kluwer Boston, Hingham, Mass.). xviii, 582 pp., illus. \$68.50. NATO Advanced Study Institutes Series C, vol. 59.

Sun Power. A Bibliography of United States Government Documents on Solar Energy. Compiled by Sandra McAninch. Greenwood, Westport, Conn., 1981. xx, 944 pp., \$75.

Superficial Keratitis. P. C. Maudgal and L. Missett, Eds. Junk, The Hague, 1981 (U.S. distributor, Kluwer Boston, Hingham, Mass.). viii, 192 pp., illus. \$45. Monographs in Ophthalmology 1. Reprinted from *Bull. Soc. Belge Ophthalmol.*, 187-1, 1980.

Syntax and Semantics. Vol. 14, Tense and Aspect. Papers from a symposium, Providence, R.I., Jan. 1977. Philip J. Tedeschi and Annie Zaenen, Eds. Academic Press, New York, 1981. xx, 306 pp. \$34.

Tooth Surface Interactions and Preventive Dentistry. Proceedings of a workshop, Oslo, Dec. 1980. Gunnar Rølla, Torleif Sønju, and Graham Embery, Eds. IRL Press, London, 1981. viii, 218 pp., illus. Paper, \$36.

Urolithiasis. Clinical and Basic Research. Proceedings of a symposium, Williamsburg, Va., June 1980. Lynwood H. Smith, William G. Robertson, and Birdwell Finlayson, Eds. Plenum, New York, 1981. xxvi, 1036 pp., illus. \$85.

Water and Related Land Resource Systems. Papers from a symposium, Cleveland, May 1980. Y. Haimes and J. Kindler, Eds. Published for the International Federation of Automatic Control by Pergamon, New York, 1981. xii, 524 pp., illus. \$120.

Water Clarification Processes. Practical Design and Evaluation. Herbert E. Hudson, Jr. Van Nostrand Reinhold, New York, 1981. xiv, 354 pp., illus. \$26.50. Van Nostrand Reinhold Environmental Engineering Series.