

creates an independent peer-review board, gives \$20 million a year to the host state, creates the Office of the Negotiator to enter into negotiations with the states on behalf of the federal government, provides for an on-site representative from the state to conduct oversight activities, and cancels the second repository.

Did Carter's book influence the restructuring of the nuclear waste program? A summary of the book published in 1987 in *Issues in Science and Technology* (vol. 3, no. 2, pp. 46–61) was widely distributed among congressional staff. At a Senate hearing, Senator Johnston referred frequently to Carter's summary in his questioning of the former Governor of Nevada, Grant Sawyer. The summary was subsequently reprinted in a Senate hearing report (S. HRG. 100–230, Pt. 1). The similarity between Carter's recommendations and the provisions in the legislation is striking. Yes, Carter's work had an impact.

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Response Hierarchies

Higher Brain Functions. Recent Explorations of the Brain's Emergent Properties. STEPHEN P. WISE, Ed. Wiley-Interscience, New York, 1987. xxii, 382 pp., illus., + plates. \$79.95. Wiley Series in Neurobiology.

Higher Brain Functions is a collection of essays on approaches to those emergent aspects of brain function that do not lend themselves to strictly biological analyses. The general focus of the collection is on high-level motor programming and the modulation of sensory processing by behavioral context.

The book is divided into three parts: Motor Aspects of Higher Brain Function, Effects of Preparatory Set, and Cerebral Organization. Parts 1 and 2 focus on presentations of the authors' research, whereas part 3 includes syntheses of research on the intrinsic circuitry of cerebral cortex, the evolution of language, imaging techniques, and the evolution of neocortex. The third section is not as thematically integrated as the first two, but the syntheses are interesting in and of themselves.

Several aspects of this collection make it particularly enlightening. First, the papers represent results and discussions at different levels of inquiry. Because the results were obtained with many techniques (from studies of performance times to studies of single brain cells) and species (from humans to

crickets), the collection could have been confusing; instead, moving from one chapter to the next tends to illuminate some interesting general principles. Second, the authors have succeeded in placing their results in a broad context, thus allowing the reader to see the mutual implications of results presented in different chapters. Third, the authors have taken to heart the editor's directive to express opinions and have produced some provocative assertions about how some higher functions are implemented by the brain.

A principle addressed in several chapters is the abstract nature of motor programming. While it seems obvious that motor behavior must reflect high-level abstraction and decision-making, it is not obvious how these processes are organized and implemented. Rosenbaum's chapter presents evidence from performance studies of humans for a hierarchical organization of motor program execution. Sequences of movements are parsed into related units in a branching tree structure. This type of organization explains results in assays of speech and finger movements, as well as some aspects of memory recall. A similar generalization of motor frameworks to higher level functions such as memory and language is the basis of MacNeilage's chapter on the evolution of language.

Another aspect of the abstract nature of motor encoding is represented in the motor equivalence results of Abbs and Cole. It appears that movements are encoded in terms of combinations of muscles, so that for any single muscle there is considerable intertrial variability but sets of muscles covary in a predictable pattern. The authors argue that "motor equivalence is the product of on-line afferent-based judgments among the constituent movements so as to accomplish planned speech goals" (p. 30).

To attain this goal-based motor programming guided by sensory information, there must be an intimate interchange of information between the output programming systems and sensory systems. The section on the effects of preparatory set deals with issues related to the interaction between sensory and motor systems. The problem of making different responses to seemingly similar stimuli on the basis of context is one that all but the most simple animals must solve. Context-dependent changes in sensory responses are presented for animals as diverse as crickets and monkeys. Some of these effects seem attributable to gating of sensory transmission: for example, a sensory response can be turned off or attenuated during certain phases of a movement. Other sensory changes, however, seem to be due to selective attention; sensory responses at sev-

eral levels can be modulated by many different behavioral processes.

Higher Brain Functions demonstrates that an interdisciplinary approach to questions pertaining to the implementation of behavior by the brain can be very profitable.

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Hosts and Parasites

Genetics and Plant Pathogenesis. P. R. DAY and G. J. JELLIS, Eds. Blackwell Scientific, Palo Alto, CA, 1987. x, 352 pp., illus. \$50. From a meeting, Egham, U.K., Dec. 1985.

Populations of Plant Pathogens. Their Dynamics and Genetics. M. S. WOLFE and C. E. CATEN, Eds. Blackwell Scientific, Palo Alto, CA, 1987. viii, 280 pp., illus. \$80. From a meeting, Leeds, U.K., Dec. 1983.

Genetic relationships in interactions between hosts and parasites occupy a central and influential position in phytopathological research. Knowledge of the number of genes involved and the ways in which they condition host resistance and parasite virulence has important consequences for studies on subjects ranging from biochemical and cellular aspects of plant pathogenesis to the population genetics of plant pathogens and the breeding of disease-resistant crops. *Genetics and Plant Pathogenesis* and *Populations of Plant Pathogens* are composed of papers given at two meetings of the British Society for Plant Pathology. Together they represent the current approaches employed in examining the genetics of host-parasite relationships at the molecular, individual, and population levels.

Genetics and Plant Pathogenesis describes recent research on the genetics of pathogenicity and virulence of plant pathogens and on the expression of host resistance. In the first paper Peter Day sets the tone of the book by discussing how molecular biology might be used to conduct research deemed to be intractable by classical genetics. The identification of avirulence genes in *Pseudomonas syringae* through transformation, cloning, and nucleic acid hybridization is discussed along with the prospects of using transformation to isolate and characterize pathogenicity genes in fungi. Also included is the use of restriction fragment-length polymorphism (RFLP) to distinguish different *formae specialis* of *Erysiphe graminis*, an important fungal pathogen of cereals. Day concludes by discussing the prospects of

genetically engineered disease resistance and the concerns and difficulties associated with the testing and release of genetically engineered agricultural microorganisms.

The papers that follow include detailed reviews of genome organization and gene regulation and expression in tobacco mosaic virus and cauliflower mosaic virus, along with a chapter examining models of genetic interaction between plant pathogenic viruses and their hosts. The genera *Pseudomonas* and *Xanthomonas* are examined with regard to the use of transposable elements and site-specific mutagenesis to identify genes controlling pathogenicity. In a paper detailing the genetics of *Bremia lactucae*, I. A. Crute presents a compelling and practical argument for studying the genetics of plant pathogens by using data on the occurrence and virulence of fungicide-insensitive isolates to develop a highly effective control program combining host resistance and fungicide use. Crute also shows the effects of gene dosage on infection types and the inhibition of avirulence genes by regulatory loci. In a related chapter by R. W. Michelmore *et al.*, progress in the use of RFLP to isolate avirulence genes in *B. lactucae* is examined. Other papers describe recent research on the genetics of mating type and isozyme markers in *Phytophthora infestans*. The final papers discuss genetic control of the synthesis and accumulation of phytoalexins and molecular regulation and characterization of gene products related to resistance.

Overall, the treatment of diverse groups of plant pathogens is well balanced. The relative detail in the individual papers is generally a reflection of the amount of genetic and molecular research that has been conducted for the respective pathogen groups. The book accurately presents the current state of molecular and genetic research for many important plant pathogens.

Populations of Plant Pathogens examines genetic and epidemiological aspects of plant pathogen populations. The book is divided into three sections: basic concepts of pathogen population genetics, dynamics of pathogen populations, and genetic changes in pathogen populations. In the opening paper Day and M. S. Wolfe stress the importance of population genetics by discussing the inherent ability of plant pathogens to genetically adapt to resistant host cultivars. They also correctly point out that population genetics in plant pathology has largely been neglected, given its relative importance. Part I includes papers discussing exceptions to classical gene-for-gene interactions in host-parasite systems, factors that influence virulence gene frequency in pathogen populations, the fate of virulent mutants

in populations, the concept of race in plant pathology, and the measurement of genetic diversity in pathogen populations. Part 2 examines mathematical modeling of disease dynamics, effects of spore-dispersal gradients on disease development, and the epidemiology of soil-borne pathogens and plant viruses among other topics. In part 3, various aspects of the adaptation of pathogen populations to host resistance are discussed with reference to southern corn leaf blight, cereal rusts, downy mildew of lettuce, Dutch elm disease, and powdery mildew of barley.

I found all the papers well written and authoritative. A common theme of parts 1 and 3 is that many plant pathogen populations do not meet the assumptions inherent in classical population genetics studies. Several of the authors point out that although race surveys of plant pathogens are extremely valuable for determining levels of virulence to host resistance genes, they may not be suitable for evaluating either the effects of virulence associations on fitness or of "stabilizing selection" in pathogen populations. My only criticism is that part 2 is isolated from the rest of the book. In the preface the editors state that aspects of population genetics and population dynamics as covered in the first two parts are brought together in part 3; however, part 3 is a continuation of part 1, with little reference to the epidemiological material in part 2. Perhaps this reflects the current distance between population dynamics and genetics in plant pathology. Taken as a whole, however, this book is at present the best collection of papers dealing with the population genetics of plant pathogens, and I recommend it highly to all those concerned with theoretical and practical aspects of this subject.

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Books Received

The Abortion Question. Hyman Rodman, Betty Sarvis, and Joy Walker Bonar. Columbia University Press, New York, 1987. xvi, 223 pp., \$27.

Aquatic Biology and Hydroelectric Power Development in New Zealand. P. R. Henriques, Ed. Oxford University Press, New York, 1987. viii, 280 pp., illus. \$65.

Astrophysical Jets and Their Engines. Wolfgang Kundt, Ed. Reidel, Dordrecht, 1987 (U.S. distributor, Kluwer, Norwell, MA). xii, 256 pp., illus. \$59.50. NATO Advanced Science Institutes Series C, vol. 208. From an institute, Erice, Italy, Sept. 1986.

Before Lift-Off. The Making of a Space Shuttle Crew. Henry S. F. Cooper, Jr. Johns Hopkins University Press, Baltimore, MD, 1987. xvi, 270 pp., illus. \$18.50. New Series in NASA History.

Biology of Copper Complexes. John R. J. Sorenson, Ed. Humana, Clifton, NJ, 1987. xx, 598 pp., illus. \$79.50. Experimental Biology and Medicine. From a symposium, Little Rock, AR, 1986.

Case Studies of Seven Commercial Seaweed Resources. M. S. Doty, J. F. Caddy, and B. Santelices, Eds. Food and Agriculture Organization of the United Nations, Rome, 1986 (U.S. distributor, Bernan/Unipub, Lanham, MD). x, 311 pp., illus. Paper, \$19.25. FAO Fisheries Technical Paper 281.

The Challenge of New Technology. David Simpson, Jim Love, and Jim Walker. Wheatsheaf, Brighton, U.K., and Westview, Boulder, CO, 1987. x, 159 pp. \$32.50.

Chaos. Making a New Science. James Gleick. Viking, New York, 1987. xiv, 352 pp., illus., + plates. \$19.95.

Chronic Lymphocytic Leukemia. Recent Progress and Future Direction. Robert Peter Gale and Kanti R. Rai, Eds. Liss, New York, 1987. xx, 432 pp., illus. \$80. UCLA Symposia on Molecular and Cellular Biology, vol. 59. From a symposium, Napa, CA, Dec. 1986.

Circle of the Seasons. The Journal of a Naturalist's Year. Edwin Way Teale. Dodd, Mead, New York, 1987. 263 pp., illus. \$17.95; paper, \$9.95. The Edwin Way Teale Library of Nature Classics. Reprint, 1953 edition.

Collisions of Electrons with Atoms and Molecules. G. F. Drukarev. Plenum, New York, 1987. x, 242 pp., illus. \$49.50. Physics of Atoms and Molecules. Translated from the Russian edition.

Droll Science. Being a Treasury of Whimsical Characters, Laboratory Levity, and Scholarly Follies. Robert L. Weber, Compiler. Humana, Clifton, NJ, 1987. viii, 340 pp., illus. \$22.50.

Dwellings. The House Across the World. Paul Oliver. University of Texas Press, Austin, TX, 1987. 256 pp., illus. \$34.95; paper, \$21.95.

Ecological Effects of In Situ Sediment Contaminants. R. Thomas *et al.*, Eds. Junk, Dordrecht, 1987 (U.S. distributor, Kluwer, Norwell, MA). viii, 272 pp., illus. \$127.50. Developments in Hydrobiology, 39. From a workshop, Aberystwyth, Wales, Aug. 1984.

Economic Aspects of Biotechnology. Andrew J. Hacking. Cambridge University Press, New York, 1987. x, 306 pp., illus. Paper, \$19.95. Cambridge Studies in Biotechnology, vol. 3. Reprint, 1986 edition.

Electronic Band Structure and Its Applications. M. Yussouff, Ed. Springer-Verlag, New York, 1987. viii, 440 pp., illus. \$41.70. Lecture Notes in Physics, 283. From a school, Kanpur, India, Oct.-Nov. 1986.

Epstein-Barr Virus and Human Disease. P. H. Levine *et al.*, Eds. Humana, Clifton, NJ, 1987. xxxii, 530 pp., illus. \$74.50. Experimental Biology and Medicine. From a symposium, St. Petersburg, FL, Oct. 1986.

Explorations in Psychoneuroimmunology. Ruth Lloyd. Grune and Stratton (Harcourt Brace Jovanovich), Orlando, FL, 1987. xiv, 162 pp. \$34.50. Seminars in Psychiatry.

Five Kingdoms. An Illustrated Guide to the Phyla of Life on Earth. Lynn Margulis and Karlene V. Schwartz. 2nd ed. Freeman, New York, 1987. xviii, 376 pp., illus. \$35.95; paper, \$24.95.

Genetic Maps 1987. Vol. 4. Stephen J. O'Brien, Ed. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY, 1987. x, 755 pp., illus. Spiral bound, \$55.

Geotectonic Evolution of China. Ren Jishun *et al.* Science Press, Beijing, and Springer-Verlag, New York, 1987. x, 203 pp., illus., + plates. \$69.

Geriatric Psychiatry and the Law. Richard Rosner and Harold I. Schwartz, Eds. Plenum, New York, 1987. xxii, 364 pp. \$49.50. Critical Issues in American Psychiatry and the Law, vol. 3.

Guidelines on the Termination of Life-Sustaining Treatment and the Care of the Dying. Hastings Center, Briarcliff Manor, NY, 1987. xii, 159 pp. Paper, \$14.50.

A Handbook of Fourier Theorems. D. C. Champeney. Cambridge University Press, New York, 1987. xii, 185 pp. \$39.50.

The Health Century. Edward Shorter. Doubleday, New York, 1987. xvi, 304 pp., illus., + plates. \$21.95. A companion to a PBS television series.

The International Encyclopedia of Astronomy. Patrick Moore, Ed. Orion, New York, 1987. 464 pp., illus. \$40.

Inventory and Monitoring of Wildlife Habitat. Allen Y. Cooperrider, Raymond J. Boyd, and Hanson R. Stuart, Compilers and Eds. U.S. Department of the Interior, Bureau of Land Management, Denver, CO, 1986 (available from the Superintendent of Documents, Washington, DC). xx, 858 pp., illus. \$38.

Kinematic Modeling, Identification, and Control of Robotic Manipulators. Henry W. Stone. Kluwer, Norwell, MA, 1987. xxii, 224 pp., illus. \$45. Kluwer International Series in Engineering and Computer Science, 29.

Light. Michael I. Sobel. University of Chicago Press, Chicago, 1987. x, 263 pp., illus. \$29.95.