genes influencing mating preferences and the preferred character or characters. Thus, popular methods based on optimality criteria, game theory, and kin selection are inadequate for the study of sexual selection and the evolution of mating systems. O'Donald's discussion of this topic (p. 58) would have benefited from a reference to the extensive work of Sewall Wright and others on frequency-dependent selection.

After summarizing the ecological and behavioral mechanisms of sexual selection, O'Donald describes three models in which all females in a population have the same (genetically fixed) type of mating preference: complete, partial, or frequency-dependent. The effect of each type of mating preference is modeled in all possible combinations with genetic variation in the male character as determined by two alleles at one locus: a dominant, codominant, or recessive trait with or without natural selection. O'Donald presents a simplified analysis of the evolutionary dynamics of the models, assuming genotypes are in Hardy-Weinberg proportions and selection is weak. An important result is that, unlike natural selection, the evolution of a recessive allele favored by sexual selection is much faster than that of a dominant allele. The chapter on monogamous species contains some of O'Donald's most original contributions and supports the theory of Darwin and Fisher that sexual selection can operate without polygamy. The final chapters are devoted to the evolution of mating preferences, using basic two-locus genetic models, and to assortative mating and sexual selection at a diallelic locus.

The major shortcoming of the book is its limitation to simple genetic systems where the fixation of an allele at one locus prevents further evolution of a trait. Although he confirmed the qualitative aspects of Fisher's theory, O'Donald claims that Fisher erred in concluding that the joint evolution of a male character and female mating preferences could result in an unstable exponential increase in both traits. With notable exceptions, such as some color polymorphisms, natural variation in quantitative characters is usually polygenic. For most dynamic systems the rate of evolution near an unstable equilibrium is approximately exponential, and when genetic variation is maintained by polygenic mutation and recombination Fisher's description may be rather accurate. It therefore appears that the qualitative theories of Darwin and Fisher are essentially correct for polygenic characters. The primary tasks for modern students of sexual selection are to develop quantitative models of these theories and to use them as conceptual tools in the empirical investigation of the behavioral and genetic mechanisms involved. *Genetic Models of Sexual Selection* is outstanding in both respects.

RUSSELL LANDE
Department of Biophysics and Theoretical Biology, University of Chicago, Chicago, Illinois 60637

Membrane Processes

Membrane Transduction Mechanisms. Papers from a symposium. RICHARD A. CONE and JOHN E. DOWLING, Eds. Raven, New York, 1979. xii, 236 pp., illus. $27. Society of General Physiologists Series, vol. 33.

Membrane Transduction Mechanisms is a collection of papers presented at the 33rd symposium of the Society of General Physiologists. The range of phenomena and experimental approaches addressed is wide, from antigen recognition to organ development, from diffraction studies to electrophysiology. This is both the volume's excitement and its weakness. The authors in general have done an excellent job of presenting their material with a broad readership in mind, but nonetheless the mental shifting of gears on moving from chapter to chapter is considerable, and one leaves the volume with an impression of a collection rather than of a unified presentation of any sort. An introductory chapter by the editors, posing general questions regarding transduction processes in membranes and tracing common motifs recurring among various specific systems, would have provided valuable cohesion and perspective.

With bacteriorhodopsin as the primary example, Henderson in a stimulating chapter suggests some generalizations regarding the structure of membrane-bound proteins: they should possess regular secondary structure such as α-helix at their interfaces with the lipid chains, and they should penetrate the bilayer completely if they penetrate it at all. Semi-integral proteins, which necessarily would have bend regions embedded in the bilayer, would therefore have unsatisfied hydrogen bonds and be energetically unfavorable. Residues believed to be involved in ion pumping, although hydrophilic, do not appear to create a domain with aqueous access, but rather a tightly knit array that would be consistent with their function in specific transport. Structural information regarding the retinal pigment rhodopsin (Hubbell and Fung), although harder to come by and of lower resolution, is consistent with these conclusions. Stoeckenius presents evidence for a light-induced isomerization of the bacteriorhodopsin prosthetic group (retinal). With the reasonable assumption that this isomerization results in a conformational change of the protein, the retinal-lysine Schiff base is postulated to be both the switch that "open-circuits" the proton conductance path in the absence of light and the pump that, by means of a pK shift energized by light, permits transport of protons against their energy gradient.

The enormous importance of calcium in communication between compartments is evident in many of the chapters. MacLennan and Klip review current knowledge and models concerning the calcium pump of the sarcoplasmic reticulum (diagrams would have made the models clearer); they emphasize that, since there does not seem to be a significant electrical potential across this membrane, flux of ions other than calcium (possibly magnesium, which is required for ATP hydrolysis by the pump) must be involved. Amino acid sequence information for a fragment essential for transport is consistent with a helix with a hydrophilic core, a structure conforming to the general predictions discussed by Henderson. However, the implied function of this region as the ionophore of the calcium pump is disputed by other workers.

The exquisite interlocking regulation of membrane transduction systems is nicely analyzed (in the context of cell activation) by Rasmussen and Clayberger. The regulation includes the activation of GTP-driven cyclase activity by hormone-bound receptor, with the simultaneous activation of GTPase activity to ensure the progressive termination of this cyclic AMP synthesis; the intimate relationship between calcium and cyclic AMP (is there special significance to cells using such disparate signals in combination?); the tuning of response by varying functional receptor concentration; and so on.

What determines the organization of actin filaments in various mechanotransducing systems such as microvilli or the acrosomal process of certain sperm? Evidence is accumulating (Tilney) that the mechanism utilizes actinin or actinin-like baseplates to originate nucleation of actin filament formation in the appropriate arrangement, with close regulation of free actin concentration at the level

at which spontaneous nucleation events elsewhere are improbable. This of course pushes the question back one stage—what determines the organization of the baseplate?

An attempt to comprehend any stimulus-response system in its entirety might seem hopeless, but in one such system, bacterial chemotaxis (Adler and coauthors), such an attempt is being made—with considerable success so far. Control of a proton-driven motor between two states (counterclockwise and clockwise rotation) by environmental stimuli is achieved by receptor-mediated methylation of membrane-bound proteins.

There are too many chapters to permit discussion here of all of them individually, but the comments above should give some idea of the richness and flavor of this book.

ROBERT M. MACNAB
Department of Molecular Biophysics and Biochemistry, Yale University, New Haven, Connecticut 06511

Books Received

Analytical Archaeologist. Collected Papers of David L. Clarke. Edited by his colleagues. Academic Press, New York, 1979. xiv, 556 pp., illus. $28.25. Studies in Archeology.

Animal Models for Research on Contraception and Fertility. Proceedings of a symposium, Washington, D.C., May 1978. Nancy J. Alexander, Ed. Harper and Row Medical Department, Hagerstown, Md., 1979. xvi, 608 pp., illus. $22.50.

Animal Reproduction. Papers from a symposium, Beltsville, Md., May 1978. Allanheld, Osmun, Montclair, N.J., and Halsted (Wiley), New York, 1979. xii, 434 pp., illus. $27.50. Beltsville Symposia in Agricultural Research, 3.

Annual Review of Anthropology. Vol. 8. Bernard J. Siegel, Alan R. Beals, and Stephen A. Tyler, Eds. Annual Reviews, Palo Alto, Calif., 1979. x, 638 pp., illus. $17.

Annual Review of Energy. Vol. 4. Jack M. Hollander, Melvin K. Simmons, and David O. Wood, Eds. Annual Reviews, Palo Alto, Calif., 1979. x, 560 pp. $17.

Annual Review of Phytopathology. Vol. 17. Raymond G. Grogan, George A. Zentmyer, and Ellis B. Cowling, Eds., Annual Reviews, Palo Alto, Calif., 1979. xii, 552 pp. $17.

Color Atlas and Textbook of Macropathology. Walter Sandritter and C. Thomas. Translated from the German edition (Stuttgart, 1977) and edited by W. H. Kirsten. Year Book Medical Publishers, Chicago, ed. 3, 1979. xvi, 380 pp. $59.95.

Combinatorial Optimization. Papers from a school, Urbino, Italy. May 1977. Nicos Christofides, Aristide Mingozzi, Paolo Toth, and Claudio Sandi, Eds. Wiley-Interscience, New York, 1979. x, 426 pp., illus. $47.

Combinatorial Theory. Martin Aigner. Springer-Verlag, New York, 1979. viii, 484 pp., illus. $39. Grundlehren der mathematischen Wissenschaften 234.

Common Bacterial Infections in Infancy and Childhood. Diagnosis and Treatment. M. I. Marks, Ed. University Park Press, Baltimore, 1979. xvi, 140 pp. Paper, $9.95.

Communication with Extraterrestrial Intelligence. Papers from meetings, 1975–1977. John Billingham and Rudolf Peřk, Eds. Pergamon, New York, 1979. vi, 226 pp., illus. + appendix. $35. Originally published as a special issue of *Acta Astronautica*, vol. 6, Nos. 1–2.

Communications Research in Learning Disabilities and Mental Retardation. Papers from a conference, Columbia, Md., 1978. James E. Button, Thomas C. Lovitt, and Thomas D. Rowland, Eds. University Park Press, Baltimore, 1979. xii, 356 pp., illus. Paper, $19.50.

Commutative Rings Whose Finitely Generated Modules Decompose. Willy Brandal. Springer-Verlag, New York, 1979. ii, 116 pp. Paper, $9. Lecture Notes in Mathematics, vol. 723.

Electron and Positron Spectroscopies in Materials Science and Engineering. Papers from a meeting. Chicago, 1977. Otto Buck, John K. Tien, and Harris L. Marcus, Eds. Academic Press, New York, 1979. xviii, 340 pp., illus. $36. Materials Science and Technology.

Electron Microscopy and Microanalysis of Crystalline Materials. J. A. Belk, Ed. Applied Science Publishers, London, 1979. x, 240 pp., illus. $29.40.

Electron Microscopy of the Kidney. In Renal Disease and Hypertension. A Clinicopathological Approach. Anil K. Mandal with the collaboration of James E. Wenzl. Plenum, New York, 1979. xx, 452 pp., illus. $32.50.

Electron-Molecule and Photon-Molecule Collisions. Papers from a conference, Pacific Grove, Calif., Aug. 1978. Thomas Rescigno, Vincent McKoy, and Barry Schneider, Eds. Plenum, New York, 1979. x, 356 pp., illus. $39.50.

Electrons and Phonons in Layered Crystal Structures. T. J. Wieting and M. Schlüter, Eds. Reidel, Boston, 1979. xii, 474 pp., illus. $78.95. Physics and Chemistry of Materials with Layered Structures, vol. 3.

Glucagon in Gastroenterology. Proceedings of a workshop, Madrid, May 1978. J. Picazo, Ed. University Park Press, Baltimore, 1979. 146 pp. $13.95.

Glycoconjugate Research. Vol. 1. Proceedings of a symposium, Woods Hole, Mass., Sept. 1977. John D. Gregory and Roger W. Jeanloz, Eds. Academic Press, New York, 1979. l, 572 pp., illus. $32.

Gradient Modeling. Resource and Fire Management. Stephen R. Kessell. Springer-Verlag, New York, 1979. xvi, 432 pp., illus. $39.80.

The Handbook of Animal Welfare. Biomedical, Psychological, and Ecological Aspects of Pet Problems and Control. Robert D. Allen and William H. Westbrook, Eds. Garland STPM Press, New York, 1979. xiv, 252 pp. $22.50.

Health Effects of Halogenated Aromatic Hydrocarbons. Papers from a conference, New York, June 1978. William J. Nicholson and John A. Moore, Eds. New York Academy of Sciences, New York, 1979. x, 730 pp., illus. $115. *Annals of the New York Academy of Sciences*, vol. 320.

Introduction to Chemical Nomenclature. R. S. Cahn and O. C. Dermer. Butterworths, Boston, ed. 5, 1979. viii, 200 pp., illus. $27.50.

An Introduction to Radiation Dosimetry. S. Lovell. Cambridge University Press, New York, 1979. x, 116 pp., illus. Cloth, $18.50; paper, $5.50. Techniques of Measurement in Medicine, 4.

An Introduction to Systems Analysis. With Ecological Applications. John N. R. Jeffers. University Park Press, Baltimore, 1979. x, 198 pp., illus $24.50. A Series of Student Texts in Contemporary Biology.

An Introduction to the Interpretation of Quantal Responses in Biology. P. S. Hewlett and R. L. Plackett. University Park Press, Baltimore, 1979. vi, 82 pp., illus. Paper, $11.95.

An Introduction to the Theory of Seismology. K. E. Bullen. Cambridge University Press, New York, ed. 3, 1979. viii, 380 pp., illus. Paper, $12.95. Reprint of the 1963 edition.

Ions and Ion Pairs and Their Role in Chemical Reactions. Papers from a symposium, Syracuse, N.Y., May 1978. J. Smid, Ed. Pergamon, New York, 1979. Variously paged, illus. $30. Reprinted from *Pure and Applied Chemistry*, Vol. 51, Nos. 1 and 4.

Mathematical Principles of Mechanics and Electromagnetism. C.-C. Wang. Plenum, New York, 1979. Two volumes. Part A, Analytical and Continuum Mechanics. xiv + pp. 1–198 + index. $27.50. Part B, Electromagnetism and Gravitation. xiv + pp. 199–386 + index. $27.50. Mathematical Concepts and Methods in Science and Engineering, vols. 16 and 17.

Mathematical Programming. Structures and Algorithms. Jeremy F. Shapiro. Wiley-Interscience, New York, 1979. xviii, 388 pp. $23.95.

McGraw-Hill Encyclopedia of Ocean and Atmospheric Sciences. Sybil P. Parker, Ed. McGraw-Hill, New York, 1980. x, 580 pp., illus. $34.50.

Medical Information Systems. The Laboratory Module. Ralph R. Grams. Human Press, Clifton, N.J., 1979. xxiv, 430 pp., illus. $39.50.

Metal Pollution in the Aquatic Environment. U. Förstner and G. T. W. Wittmann with contributions by F. Prosi and J. H. van Lierde. Springer-Verlag, New York, 1979. xvi, 486 pp., illus. $54.

The Natural History of the Mind. Gordon Rattray Taylor. Dutton, New York, 1979. xiv, 370 pp. $14.95.

The New York Summer Aerosol Study, 1976. Papers from a meeting, New York, Apr. 1977. Theo. J. Kneip and Morton Lippmann, Eds. New York Academy of Sciences, New York, 1979. vi, 166 pp., illus. $30. *Annals of the New York Academy of Sciences*, vol. 322.

Operator Algebras and Quantum Statistical Mechanics 1. C*- and W*-Algebras, Symmetry Groups, Decomposition of States. Ola Bratteli and Derek W. Robinson. Springer-Verlag, New York, 1979. xii, 500 pp. $36. Texts and Monographs in Physics.

Organic Reactions and Orbital Symmetry. T. L. Gilchrist and R. C. Storr. Cambridge University Press, New York, ed. 2, 1979. viii, 312 pp., illus. Cloth, $49.50; paper, $16.95. Cambridge Texts in Chemistry and Biochemistry.

Organic Stereochemistry. Henri Kagan. Translated from the French edition (1975) by M. C. Whiting and U. H. Whiting. Halsted (Wiley), New York, 1979. viii, 166 pp., illus. Paper, $14.95.

Organics Analysis Using Gas Chromatography/Mass Spectrometry. A Techniques and Procedures Manual. William L. Budde and James W. Eichelberger. Ann Arbor Science. Ann Arbor, Mich., 1979. xxviii, 242 pp. $20.

Plant Growth Substances. Papers from a symposium, West Long Branch, N.J., Mar. 1979. N. Bhushan Mandava, Ed. American

(Continued on page 313)