

BOOK REVIEWS

A Developmental Question

Genomic Potential of Differentiated Cells. MARIE A. DI BERARDINO. Columbia University Press, New York, 1997. xvi, 386 pp., illus., + plates. \$65 or £52. ISBN 0-231-06986-3.

This book is both a monograph on the author's major research focus, the genomic potential of differentiated cells in amphibians, and a memoir of her work and associations with those investigators who have addressed the problem over the past 50 or so years. In a brief historical review, she recaptures the excitement surrounding the early amphibian nuclear transplantation experiments by Briggs and King that set the course for much of her subsequent career. Although blastula cell nuclei of the frog *Rana*, when transplanted into activated enucleated eggs, promote normal development, those taken at later stages, with more frankly differentiated cells, show a progressive decline in the number of totipotent nuclei. The author holds that this restriction is a result of differentiation and that those few cells whose nuclei do support normal development are probably stem cells whose differentiation is incomplete. Others, notably John Gurdon, emphasize the positive results, postulating that nuclei remain totipotent throughout differentiation.

An extensive treatment of subsequent work follows that amply repays close reading. The developmental potentials of nuclei from many differentiated amphibian cells are detailed, along with the various means by which this potential may be enhanced. Tissue culture prior to transplantation, serial transplantation, low temperature, chemical protection of the DNA, and viral transformation are all to a greater or lesser extent effective in improving the normal development of nuclear transplant recipients. This demonstrates that the differentiated nuclei are multipotential but does not prove totipotency. Nuclear potential in other vertebrates and invertebrates is reviewed through 1996 without altering this conclusion. Differentiation-associated genetic loss and other structural alterations are reviewed, as are reversible genomic alterations such as imprinting. The work of each laboratory, whether it accords or not with the author's views, is fairly presented and thoughtfully

analyzed. The format of the book has allowed her to inject her own interpretations, which are insightful and thought-provoking.

Two major results present problems with respect to the major thesis of the book. First, the recent finding of Wilmut *et al.* that adult sheep nuclei can promote complete and normal development in a nuclear transplant recipient demonstrates totipotency. The author argues that the singular Dolly results from a stem cell nucleus, but this begs the question of what is the state of differentiation of a stem cell. Second, the ability of differentiated plant cells to reconstitute fully functional and fertile plants shows that differentiation is not necessarily accompanied by irreversible loss of genomic potential. Although this may be related to the absence of a separate germ line in plants, it is difficult to identify a plausible evolutionary reason for or against maintenance of totipotency of differentiated nuclei. Fuller understanding of the molecular mechanisms of normal differentiation may ultimately answer the question whether there is an essential block to totipotency in differentiated cells. Meanwhile, the improving ability to tease increasingly complete developmental programs from differentiated cells or nuclei bodes well for those interested in regeneration of lost physiological functions and structures in humans. This volume, by drawing together the diverse literature, provides an essential guide to the possibilities and pitfalls in such procedures.

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Aquatic Nonconformists

Air-Breathing Fishes. Evolution, Diversity, and Adaptation. JEFFREY B. GRAHAM. Academic Press, San Diego, 1997. xii, 299 pp., illus. \$79.95 or £55. ISBN 0-12-294860-2.

Long before they were provided with a theoretical framework for the role of natural selection in evolution, biologists were struggling to explain the existence and signifi-



"Overhead view of *Dormitator* aggregated at a dam," Panama, 1972, "apparently driven out of their backwater habitats in response to heavy use of insecticide sprays. Each fish is positively buoyant and its aerial-respiratory frontal skin patch is exposed to air." [From *Air-Breathing Fishes*]



"*Synbranchus marmoratus* at the surface of a mud burrow." [From *Air-Breathing Fishes*; L. Ford, Scripps Institution of Oceanography]

cance of air-breathing fishes. How could some forms of fishes not only come to the water's surface to breathe air but, in the case of some species, actually venture onto land to forage, escape predation, or even migrate? Could these amphibious curiosities be stepping stones in the movement of life out of the oceans onto land? The early notion that extant air-breathing fishes—and especially the lobe-finned lung fishes—were some sort of missing link between typical aquatic fish and truly amphibious vertebrates was dispelled as a greater understanding of vertebrate phylogeny developed from the fossil record and systematic study of extant fishes. Even so, air-breathing fishes have continued to captivate morphologists, physiologists, and ecologists. Because air-breathing has arisen independently dozens of times in fishes, and because there are nearly 400 species of air-breathing fishes, the richness and diversity collectively presented by these animals can provide considerable insight for present-day biologists seeking to understand the selection pressures contributing to the evolution of terrestriality.

Air-Breathing Fishes: Evolution, Diversity, and Adaptation most certainly qualifies as a comprehensive, authoritative source that will be required reading for fish biologists and for biologists studying tropical aquatic ecosystems. More than this, however, Graham successfully convinces the reader that air-breathing fishes provide a powerful case study with broad implications for evolutionary biologists. Utilizing an abundance of physiological, morphological, behavioral, and biochemical clues, Graham pieces together patterns of physicochemical and biological selection pressures that underlie the evolution of air-breathing. Through a similar approach with other taxa evolutionary biologists can gain additional insight into vertebrate evolution. Thus, this book should prove useful to biologists with little or no previous knowledge of air-breathing fishes. A special strength of the book derives from Graham's years of field observations in Latin America, which enable him to use natural historical and behavioral data to color the morphological and physiological tapestry he weaves.

Graham's book is easily the most comprehensive treatment of its kind, rich in detail with abundant tabulated data and illustrations. Yet it remains refreshingly readable, entertaining and occasionally even amusing. I appreciate the rare book in this genre that leaves the reader with the impression of actually having had a conversation with an informed, enthusiastic teacher. Indeed, by the end of this book we know the names not only of Graham's fishes, but also of his mentors, his scientific heroes, his field assistants, and even his wife! Whether you are in serious pursuit of a detailed understanding of air-breathing fishes or merely curious to know a little more of the biology

behind the quiet air gulps made by that unusual aquarium fish, Graham's book is sure to please.

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Other Books Received

The American Bird Conservancy's Field Guide to All the Birds of North America. Jack L. Griggs. HarperPerennial, New York, 1997. Unpagged, illus. Paper, \$19.95 or C\$28.50. ISBN 0-06-273028-2.

Anesthesia and Analgesia in Laboratory Animals. Dennis F. Kohn *et al.*, Eds. Academic Press, San Diego, 1997. xviii, 426 pp., illus. \$99.95. ISBN 0-12417570-8. American College of Laboratory Animal Medicine.

Animal Cell Culture and Technology. The Basics. Michael Butler. IRL (Oxford University Press), New York, 1996. xii, 114 pp., illus. Paper, \$24.95 or £12.99. ISBN 0-19-963416-5.

Apoptosis Techniques and Protocols. Jude Poirier, Ed. Humana, Totowa, NJ, 1997. xii, 286 pp., illus. \$79.50. ISBN 0-89603-451-8. Neuromethods, 29.

Atlas of the Human Brain. Jürgen K. Mai, Joseph Assheuer, and George Paxinos. Academic Press, San Diego, 1997. viii, 328 pp., illus. \$135. ISBN 0-12-465360-8; paper, \$89.95. ISBN 0-12-465361-8.

Atlas of Venus. Peter Cattermole and Patrick Moore. Cambridge University Press, New York, 1997. xvi, 143 pp., illus. \$29.95. ISBN 0-521-49652-7.

Averting Extinction. Reconstructing Endangered Species Recovery. Tim W. Clark. Yale University Press, New Haven, CT, 1997. xii, 270 pp., illus. \$30. ISBN 0-300-06847-6.

Avian Molecular Evolution and Systematics. David P. Mindell, Ed. Academic Press, San Diego, 1997. xx, 382 pp., illus. \$84.95. ISBN 0-12-498315-4.

Biosensors. An Introduction. Brian R. Eggins. Wiley, New York, and Teubner, Stuttgart, Germany, 1997. xii, 212 pp., illus. \$69.95. ISBN 0-471-96285-6.

The Call of Distant Mammoths. Why the Ice Age Mammals Disappeared. Peter D. Ward. Copernicus (Springer-Verlag), New York, 1997. xx, 241 pp., illus. \$26. ISBN 0-387-94915-1.

Campylobacters, Helicobacters, and Related Organisms. Diane G. Newell, Julian M. Ketley, and Roger A. Feldman, Eds. Plenum, New York, 1997. xx, 767 pp., illus. \$175. ISBN 0-306-45312-6. From a workshop, Winchester, UK, July 1995.

Encounters in Nonlinear Optics. Selected Papers of Nicolaas Bloembergen (with commentary). Nicolaas Bloembergen, Ed. World Scientific, River Edge, NJ, 1997. xvi, 622 pp., illus. \$86. ISBN 981-02-2549-0. World Scientific Series in 20th Century Physics, vol. 16.

The Ethics of Human Gene Therapy. LeRoy Walters and Julie Gage Palmer. Oxford University Press, New York, 1997. xviii, 209 pp., illus. \$29.95. ISBN 0-19-505955-7.

The Ethics of Scientific Research. A Guidebook for Course Development. Judy E. Stern and Deni Elliot. Published for the Institute for the Study of Applied and Professional Ethics at Dartmouth College by the University Press of New England, Hanover, NH, 1997. x, 116 pp. Paper, \$15. ISBN 0-87451-798-2.

Evolutionary Social Psychology. Jeffrey A. Simpson and Douglas T. Kenrick, Eds. Erlbaum, Mahwah, NJ, 1997. xii, 424 pp., illus. \$79.95. ISBN 0-8058-1905-3; paper, \$39.95. ISBN 0-8058-2420-0.

From Chemical Topology to Three-Dimensional Geometry. Alexandru T. Balaban, Ed. Plenum, New York, 1997. xviii, 420 pp., illus. \$125. ISBN 0-306-45462-9. Topics in Applied Chemistry.

Genetic Instability in Cancer. T. Lindahl, Ed. Published for the Imperial Cancer Fund by Cold Spring Harbor Laboratory Press, Cold Spring Harbor, NY, 1996. viii, 353 pp., illus. \$90. ISBN 0-87969-485-8. Cancer Sur-

veys, vol. 28.

Handbook of Carcinogenic Potency and Genotoxicity Databases. Lois Swirsky Gold and Errol Zeiger, Eds. CRC Press, Boca Raton, FL, 1997. xiv, 754 pp. \$99.95. ISBN 0-8493-2684-2.

A History of Transplantation Immunology. Leslie Brent. Academic Press, San Diego, 1997. xxii, 482 pp., illus. \$35. ISBN 0-12-131770-6.

How To Report Statistics in Medicine. Annotated Guidelines for Authors, Editors, and Reviewers. Thomas A. Lang and Michelle Secic. American College of Physicians, Philadelphia, 1997. xxvi, 367 pp., illus. Paper, \$39.95. ISBN 0-943126-44-4. Medical Writing and Communication.

Mathematical Methods for Neural Network Analysis and Design. Richard M. Golden. Bradford (MIT Press), Cambridge, MA, 1997. xvi, 419 pp., illus. \$65. ISBN 0-262-07174-6.

Molecular Gerontology. Research Status and Strategies. Suresh I. S. Rattan and Olivier Toussaint, Eds. Plenum, New York, 1996. viii, 216 pp., illus. \$69.50. ISBN 0-306-45491-2.

Multivariate Statistical Methods. A First Course. George A. Marcoulides and Scott L. Hershberger. Erlbaum, Mahwah, NJ, 1997. xii, 322 pp., illus. \$89.95. ISBN 0-8058-2571-1; paper, \$39.95. ISBN 0-8058-2572-x.

Nature's Services. Societal Dependence on Natural Ecosystems. Gretchen C. Daily, Ed. Island Press, Washington, DC, 1997. xx, 392 pp., illus. \$49.95. ISBN 1-55963-475-8; paper, \$24.95. ISBN 1-55963-476-6.

The Nuclear Fuel Cycle. From Ore to Wastes. P. D. Wilson, Ed. Oxford University Press, New York, 1996. xx, 323 pp., illus. \$55. ISBN 0-19-856540-2.

The Oceans and Climate. Grant R. Bigg. Cambridge University Press, New York, 1997. xii, 266 pp., illus. \$49.95. ISBN 0-521-45212-0; paper, \$27.95. ISBN 0-521-58268-7.

Outer Space. Problems of Law and Policy. Glenn H. Reynolds and Robert P. Merges. 2nd ed. Westview (HarperCollins), Boulder, CO, 1997. xviii, 446 pp. \$50. ISBN 0-8133-1802-5.

Oxidative Stress and the Molecular Biology of Antioxidant Defenses. John G. Scandalios, Ed. Cold Spring Harbor Laboratory Press, Cold Spring Harbor, NY, 1997. xiv, 890 pp., illus. \$150. ISBN 0-87969-502-1. Monograph 34.

The Pony Fish's Glow. And Other Clues to Plan and Purpose in Nature. George C. Williams. BasicBooks, New York, 1997. viii, 184 pp., illus. \$20 or C\$28.50. ISBN 0-465-07281-x. Science Masters.

Principles of Tissue Engineering. Robert P. Lanza, Robert Langer, and William L. Chick, Eds. Academic Press, New York, and Landes, Austin, TX, 1996. xxviii, 808 pp., illus. \$125. ISBN 0-12-436625-2.

Psychology of Russia. Past Present Future. Elena L. Grigorenko, Patricia Ruzgis, and Robert J. Sternberg. Nova, Commack, NY, 1997. iv, 457 pp. \$59. ISBN 1-56072-389-0.

Research Ethics. A Reader. Deni Elliott and Judy E. Stern, Eds. Published for the Institute for the Study of Applied and Professional Ethics at Dartmouth College by the University Press of New England, Hanover, NH, 1997. 319 pp. Paper, \$25. ISBN 0-87451-797-4.

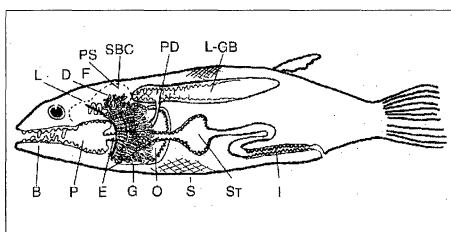
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Scientific Unit Conversion. A Practical Guide to Metrication. François Cardarelli. Springer-Verlag, New York, 1997. xvi, 456 pp. Paper, \$39.95. ISBN 3-540-76022-9. Translated by M. J. Shields.

Subduction. Top to Bottom. Gray E. Bebout *et al.*, Eds. American Geophysical Union, Washington, DC, 1996. xiv, 384 pp., illus. \$650; to AGU members, \$42. ISBN 0-87590-078-x. Geophysical Monograph, vol. 96.

Vertebrate Paleontology in the Neotropics. The Miocene Fauna of La Venta, Colombia. Richard F. Kay *et al.*, Eds. Smithsonian Institution Press, Washington, DC, 1997. xvi, 592 pp., illus. \$80. ISBN 1-56098-418-x.

Yeast Stress Responses. Stefan Hohmann and Willem H. Mager, Eds. Chapman and Hall, New York, and Landes, Austin, TX, 1997. xii, 252 pp., illus. \$89.95. ISBN 0-412-13251-6. Molecular Biology Intelligence Unit.



"Generalized air-breathing fish '*Aerospirichthys*' illustrating the [air-breathing organs] presently known, including: Modified epithelial surfaces in the buccal (B), pharyngeal (P), esophageal (E), and opercular (O) chambers, as well as the gills (G), skin (S), stomach (ST), and intestine (I). Modified spaces include, the suprabranchial chamber (SBC), or pharyngeal sacs (PS). Modified chambers include the pneumatic duct (PD), and the lung or respiratory gas bladder (L-GB). Projections into these spaces include the labyrinth (L), dendrites (D), and gill fans (F)." [From *Air-Breathing Fishes*]