



Aquatic Photosynthesis

PAUL G. FALKOWSKI,
JOHN A. RAVEN

1997. Blackwell Science,
Malden, Massachusetts,
USA

375 pp. 25 × 17.5 cm
Price: US\$ 61.95

ISBN 0-86542-387-3

This excellent text on aquatic photosynthesis can be read like a good novel. *Aquatic Photosynthesis* is an introductory textbook that integrates biophysical, biochemical, and physiological concepts of photosynthesis in the context of the ecology and evolution of aquatic organisms. By means of biogeochemistry and evolution, the book takes the reader in a scientific exploration of the fundamentals of light absorption and the biophysics of the light reactions. Intended for advanced undergraduate or postgraduate students with a general scientific background, it focuses on the fundamental concepts of the discipline, especially biochemical and biophysical mechanisms, rather than on the latest discoveries. For that reason, the information is general and does not include extensive citations to current scientific work; it rather focuses on the history of research that has led to the current understanding of photosynthesis. The emphasis on biophysics in the first few chapters sheds a new light on the processes of photosynthesis at the most basic level. The book is arranged in ten chapters. The first chapter, “An Introduction to Photosynthesis in Aquatic Systems”, is a good brief description of the overall photosynthetic process, the geochemical and biological evidence for the evolution of oxygenic organisms, and the concepts of life-forms and nutritional modes. Many of these subjects are explored in detail in subsequent chapters. Chapter two, “Light Absorption and Energy Transfer in Photosynthetic Apparatus”, discusses the nature of light and its absorption by pigments in the photosynthetic apparatus. It provides the necessary background to understand the light reactions of photosynthesis—absorption, energy transfer, and primary charge separation—that are similar in all photosynthetic organisms. Chapter three “The Photosynthetic Light Reactions,” presents the search for the mechanism of the photochemical reactions from both conceptual and historical perspectives. Chapter four “Photosynthetic Electron Transport and Photophosphorylation,” describes the different components in the photosynthetic electron transport chain that

provides chemical reductants used to assimilate inorganic carbon and chemical energy to sustain all the activity of the organism. Chapter five, “Carbon Acquisition and Assimilation,” explains how the products of the light reaction are used to fix inorganic carbon through a pathway that invariably involves the enzyme ribulose-1,5-bisphosphate carboxylase/oxygenase (Rubisco).

Chapter six, “The Molecular Structure of the Photosynthetic Apparatus,” examines the molecular architecture of the photosynthetic machinery and some aspects of the genetic regulation of the synthesis and assembly of the components of the photosynthetic apparatus. Chapter seven, “Photosynthesis in Continuous Light”, explores how this machinery operates in continuous light, and what factors determine the photosynthesis-irradiance response. Chapter eight, “Making Cells”, discusses how photosynthetic processes are integrated with the rest of the cellular machinery and are related to the making of new cells. Chapter nine, “Photosynthesis and Primary Production in Nature,” examines how the photosynthesis process acclimates to changes in natural aquatic ecosystems. It first describes how aquatic ecologists measure photosynthesis in nature, and then considers acclimation responses within the framework of what the reader must have learned in the previous chapters. The tenth and last chapter of the volume, “Aquatic Photosynthesis in Biogeochemical Cycles,” discusses some of the long-term adaptations of aquatic photosynthetic organisms to the environment and the feedback between the biotic and abiotic realms. The study of such feedbacks is essential for the understanding of how climatic phenomena and aquatic photoautotrophs interact. Interspersed throughout the book, there are 39 particularly interesting complement boxes dealing with topics such as radioactive tracers, hole burning, chlorophyll biosynthesis and UV-B inhibition.

There are only four color plates in the middle of the book. The rest of the book is in black and white and written in a plain style. I appreciate this example of book’s freshness, in contrast with many modern textbooks, crammed with images and colors. It is a pleasure to find, from time to time, a book where space is well used, and whose presentation is simple, a book that gets very clearly to the point (although the index does not include the whole contents of chapters), and which is, from a pedagogical point of view, adequate for reflection, concentration and assimilation. Sometimes, excessive help in modern textbooks make the student be off his or her guard, and the little tension necessary to get information does not activate.

In conclusion, this is an extremely interesting, useful book for anyone working with photosynthesis in aquatic organisms or needing knowledge on that topic.

Xavier Roig
University of Barcelona



Biology of Dermatophytes and Other Keratinophilic Fungi

R.K.S. KUSHWAHA,
J. GUARRO (eds)

2000. Revista Iberoamericana de Micología, Bilbao, Spain

174 pp. 28 × 25 cm
Price: 16,600 PTA (100 ₤)
ISBN 84-607-0711-3

This book is a comprehensive study of the keratinophilic fungi, which include dermatophytes, the agents of major human and animal infections such as tinea or ringworm. It also comprises a large group of fungi including species of *Aphanoascus*, *Chrysosporium*, *Penicillium*, *Fusarium*, *Cladosporium* and *Malbranchea*, which are natural colonizers of keratinic substrates, some of them being involved in the degradation of keratinized residues present in soil.

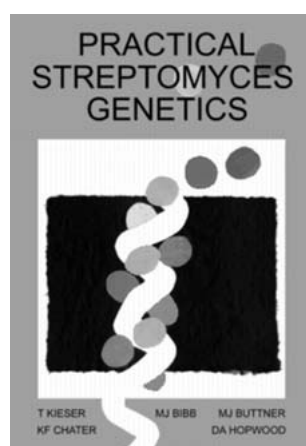
The monograph comprises twenty-one reviews and research papers describing different aspects of the keratinophilic fungi. An important part of the book deals with dermatophytes and their role in human and animal infections. Several reviews cover extensively the ecology, physiology, pathogenicity, clinical presentations, epidemiology and treatment of infections caused by dermatophytes. I have found of particular interest the sections devoted to the taxonomy of dermatophytes and members of the genus *Chrysosporium*. The taxonomy of this group, which was traditionally based on the cultural and morphological characteristics of the isolates, is being currently studied using molecular approaches based on the comparison of the sequences of the ITS1-5.8S-ITS2 rDNA regions of these fungi. The role in human infections by non-dermatophytic filamentous keratinophilic fungi (*Histoplasma*, *Chrysosporium*, *Nattractia*, *Phoma*, *Fusarium*, *Scopulariopsis*, *Aspergillus*, *Geotrichum*, *Alternaria*, *Curvularia*, and *Chaetomium*) and their in vitro susceptibility to currently used antifungals has been also reviewed. A series of papers review the evolution, geographical distribution, ecology in waste contamination and aquatic habitats of keratinophilic fungi, with an emphasis on the risk of infection associated with a contaminated environment. The use of keratinophilic fungi as bioindicators of environmental waste pollution and in bioremediation of waste and waste-contaminated sites is also discussed.

The book is well edited and contains color and black-and-white pictures to illustrate the macroscopic, microscopic and clinical characteristics of the keratinophilic fungi. Two chapters review, respectively, the ultrastructure of ascosporeogenesis of *Arthroderma simii*, and the keratinolytic activity of *Trichosporon beigeli* and *Piedraia hortae*, the agents of white-and-black piedra, respectively.

Those with an interest in the mycoses, including clinical mycologists, dermatologists and clinical pathologists, as well as microbiologists interested in soil fungi, will find up-to-date information about keratinophilic fungi in the book. With this volume, *Revista Iberoamericana de Micología* starts a new project of publishing –apart from the journal– a series of books devoted to different aspects of mycology. An electronic version of the book will be available in the near future.

José Pontón
University of the Basque Country

Practical Streptomyces Genetics



T. KIESER, M. J. BIBB,
M. J. BUTTNER, K. F. CHATER,
D. A. HOPWOOD

2000. The John Innes Foundation, Norwich, UK

613 pp. 20 × 28 cm

Price: £ 60
ISBN 0-7084-0623-8

Fifteen years after the publication of *Genetic Manipulation of Streptomyces: a Laboratory Manual*, comes *Practical Streptomyces Genetics*, the new edition of the classical *Streptomyces* manual. How much has *Streptomyces* genetics changed throughout this period of time? Comparing both editions is possibly the best way of getting the answer to this question. Just an example, whereas the old manual said, “since the *Streptomyces* chromosome is circular...,” the new edition announces that by the end of 2000, the complete sequence of the *linear* chromosome of *Streptomyces coelicolor* will be known. Of course, the change in the topology of the chromosome has not been the sole story: most protocols have been modified and improved, new genetic tools have been developed, and completely-new methodologies arisen in the last years are now also available for the study of streptomycetes. Therefore, the authors (with significant contributions of collaborators all over the world) have done considerable effort to gather all the progress in this field, to provide new protocols, and to bring up completely new chapters on topics such as biochemical methods, transposon mutagenesis, gene replacement, or reporter systems, that were either absent or briefly considered in the previous version.

Practical Streptomyces Genetics is organised in 22 chapters; each of them with a detailed content index and a reference list. However, there is neither content index nor reference list for the whole book, as in the old manual, where they were very useful to quickly locate topics, protocols and references by

author's name. Most of the chapters consist of meticulously detailed protocols, providing comments, suggestions and alternatives on every step. This is what we all expect from a manual for laboratory use. The book also combines descriptive parts, which will be a very useful source of information for those non-familiar with either the *Streptomyces* world or particular techniques. Chapter 1, for example, gives a complete description of the actinomycetes family, focusing on main aspects of *Streptomyces* biology such as physiology, antibiotic production, morphological differentiation, and genetics. It also contains an extensive list of references on all topics and *Streptomyces* species. Gene cloning and more considerations on the particular *Streptomyces* genetic system, such as the methylation of DNA, are considered in chapter 9.

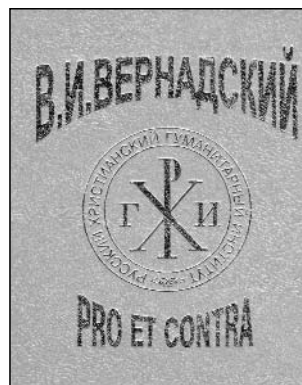
Chapter 2 deals with the growth and preservation of *Streptomyces* strains. Microscopy and biochemical techniques are considered in the following chapters, the latter including protocols to study the *Streptomyces* proteome using 2D gels. Two more chapters cover mutagenesis in both the classical methods involving irradiation and chemical treatment, and the techniques using transposons. Those enthusiastic over the classical genetic analysis methods will enjoy chapter 7, dedicated to gene-exchange methods and to genetic analysis of crosses. This chapter explains how to map genes using the four-on-four crosses, a technique developed when the chromosome was thought to be circular, but still valid with a linear chromosome. Chapter 8 offers a protocol for plasmid or genomic DNA isolation that suits one's own preferences. Methods for transformation, transfection and conjugation are described in chapter 10. A compilation of plasmids and plasmid vectors is described in chapter 11, and the maps in chapter 22. Two more chapters deal with *Streptomyces* phages and cloning in phage-derived vectors. Strategies for making gene disruption and gene replacements are given in chapter 14. Chapter 15 reviews reporter systems for *Streptomyces*, from the failures of the classical *lacZ* (it is interesting to show also things that have not worked) to the modern and powerful *gfp*. Methods for the isolation and analysis of RNA are listed in chapter 16, and chapter 17 covers the world of protein production and secretion, including a review of expression vectors. Briefly, chapter 18 describes main tools used for genome analysis and useful tables of codon usage in *Streptomyces*. Chapters 19 to 22 account for almost one third of the book extension. These chapters include media and buffer recipes, lists of strains, genetic and physical maps of the chromosome of several species, maps of plasmids, transposons, phages, resistance genes, marker genes, reporter genes, counterselectable genes and all sort of genetic tools for *Streptomyces*.

In summary, "Practical *Streptomyces* genetics" combines protocols and basic information on *Streptomyces* biology, and the result is an excellent laboratory manual. It will be a reference book for all laboratories working on *Streptomyces* research (but also for those interested in related microorganisms), as the old manual has been since it was published. Having the manual on the bench, and

the genome of *S. coelicolor* on the computer (visit the web site http://www.sanger.ac.uk/Projects/S_coelicolor/, where there is also information on this book), the next years will witness enormous progress in the knowledge of the genetics of these fascinating bacteria.

José A. Aínsa

University of Zaragoza



ISBN 5-88812-067-7

V. I. Vernadsky. Pro et Contra (In Russian)

ANDREY V. LAPO (ed)

2000. The Russian Christian Humanitarian Institute, St. Petersburg, Russia

872 pp. 21.5 × 15 cm

This book is an anthology of publications about Vladimir I. Vernadsky written during the last hundred years (1898–1998). It appeared in the series "Russian Way" dedicated to the greatest creator of the Russian history and culture. Vladimir I. Vernadsky is one of the outstanding Russian scientists who worked in the first half of the twentieth century. His ideas had a great impact on the development of many fields of natural sciences. They became crucial for modern geochemistry and biogeochemistry. Vernadsky's theories about biosphere and noosphere put his name among the names of the greatest thinkers of the world science. Due to political barriers, Vernadsky's work was scantily known to western scientists until recently. Although in his home country Vernadsky's name was recognized among the classics of natural sciences, many of his holistic approaches were subjected to political attacks.

The book under review *Vernadsky-Pro et Contra* is interesting from two points of view. First, this anthology of the most typical publications shows us Vernadsky as a scientist of encyclopedic erudition whose contribution to the world science is unique. Secondly, the readers of this book will find here many interesting facts about Vernadsky's biography and learn more about the personality and spiritual world of the great scholar. Through the pages of this book, readers will learn about the people from Vernadsky's epoch—his friends, members of his family, colleagues and disciples.

This anthology consists of three sections. The first section "Phenomenon of Vernadsky" focuses on the general assessment of Vernadsky's contribution to the world science by his contemporaries and followers. The second section "Personality of Vernadsky" contains fragments of his diary, personal and official letters, notes, questionnaires. All of these documents show Vernadsky's personality, his inner world, ethical views,

relation to religion, politics, philosophy. His words "I am living in science" (from letter to V. Volgin) seems to be the main life credo of this outstanding person. This section also includes memories of his contemporaries, friends and relatives which make the image of Vernadsky uniquely attractive. It is very interesting to learn from memories of V. Neapolitanskaya and V. Oskotsky that Vernadsky, who characterized himself as an "outside of politics person", was not scared to stand up for his repressed colleagues in the totalitarian 1930s. The fine essay by I. Mochalov about interrelations between V. Vernadsky and L. Tolstoy clarifies the roots of Vernadsky's noosphere concept.

The final section, "Epoch of Vernadsky," is the most voluminous part of the anthology. Publications are given in chronological order, and they cover three periods: 1898–1962 (The Time of Discussions), 1963–1988 (Placement on the Pedestal) and 1989–1998 (Time of Comprehension). It is fascinating to find in this section the review of the first of Vernadsky's publications in the field of crystallography written in 1898 by outstanding Russian scientist E. Fedorov, the founder of modern crystallography. Most publications of the period 1898–1962 emphasize the significance of Vernadsky's ideas for geography (L. Berg), mineralogy (D. Grigoryev), meteoritic studies (E. Krinov), crystallography (I. Shafranovsky) and biology (G. Gause, A. Perelman). Publications of the official philosophers and some scientists against Vernadsky's ideas reveal the rather dramatic episodes in the life of the great scientist, which were suppressed earlier. Vernadsky wrote in his diary in 1931: "The kingdom of my ideas will come later." His recognition today confirms this prediction. Publications of 1963–1988 concern mainly discussions around Vernadsky's concept of biosphere and noosphere. *Pro* (V. Kovda, I. Mochalov, A. Yanshin, E. Kolchinsky, A. Lapo, G. Guegamian, S. Gorshkov, etc.) and *contra* (I. Zabelin, L. Davitashvili, etc.) are presented. One can consider that Vernadsky's ideas became often widely known even though they were not attributed to their author. So, J. Lovelock admits that neither he nor L. Margulis were aware of Vernadsky's work when they introduced their Gaia hypothesis in 1972. Lovelock declares Vernadsky to be his and Margulis' famous predecessor. GE Hutchinson, the known American scholar, also notices the great influence of Vernadsky's ideas on the development of his own ecological concepts. N. Polunin and J. Grinevald estimate the scientific heritage of Vernadsky as the "Vernadskian revolution", and they emphasize its importance for the solution of global ecological problems. Authors of some publications discuss the relation between scientific, philosophical and humanitarian ideas of Vernadsky. They consider Vernadsky to be one of the brightest representatives of the so-called Russian paradigm (G. Zavarzin) or Russian cosmism (N. Moiseyev). The foreword of well-known scientists from twelve countries to the first English edition of Vernadsky's *The Biosphere* (1998) completes the anthology. The passionate call for the study of Vernadsky's work can be heard from this foreword.

The editor of this book, A. Lapo, carried out a noble mission. In general, fragments of 111 publications as well as comments

and references to them are included in the anthology. The book leaves one with desire to read full publications of many authors. Certainly it will be of interest not only to professional scientists, but also to general readers concerned with the global problems of mankind.

Albina Afinogenova Rukhin

Smithsonian Environment Research Center



Manual de estilo de la lengua española

JOSÉ MARTÍNEZ DE SOUSA

2000. Ediciones Trea,
Gijón, Spain

640 pp. 24 × 17 cm

Price: 5525 PTA (33 ¢)
ISBN 84-95178-61-3

In the last ten years many books claiming to be authoritative style manuals for modern Spanish have been published, but no earlier offering approaches the scope, rigor and depth of coverage of Martínez de Sousa's *Manual*. The second most widely spoken modern language in the world, and the only European language that is currently gaining in number of users, at last has its equivalent of *The Chicago Manual of Style*.

Throughout his long and intense life in the field of editing and publishing, the author has worked as a typesetter and proofreader, copyeditor, production editor, lexicographer, philologist, orthographer, grammarian, and consultant to academic publishers. His knowledge of practically every aspect of information transfer via the printed word is thus based on hands-on professional experience. The author does all his own layout and typesetting for all his books, including this one, which is therefore doubly valuable both for its content and as an example of how to place print on the page (or screen).

In the Introduction Martínez de Sousa provides an excellent overview of standardization, style and publishing; this section ends with a specialized bibliography of style manuals and other works on publishing. The first of the two main parts of the *Manual*, headed "El trabajo intelectual" (Intellectual work), covers documentation and citation, writing, orthotypography and bibliography (i.e., types of publishers, editorial and review boards, types of publishing, handling of manuscripts, diacrisis [the use of different typefaces in running text], printing, and the elements of scholarly books).

The second part, headed "Diccionario de materias" (Dictionary of topics), is an alphabetical listing of terms and expressions relating to editing and publishing. The author has

taken a broad view here, and has included not only technical terms but also words that create confusion for the every-day user of Spanish. For example, the first six entries under the letter “i” are *ictiónimos, impresos, indios, indonesio, industria y comercio, and informática*. A more general bibliography concludes this section.

Throughout the text are scattered no fewer than 73 charts and tables. A sample of the titles illustrates the enormous variety of areas this manual covers: “Abbreviations used in bibliographies,” “Families of typefaces,” “Words for which accentuation is unclear,” “Symbols for major airports,” “Biblical symbols in Spanish and Latin,” “Spanish anthroponyms,” “Cyrillic alphabet,” “Spanish awards and decorations,” “Words derived from the names of Spanish football teams,” “Formats for dates,” “Biological classification,” “Latin expressions,” “Musical notation” and “Spanish onomatopoeias.”

Most usefully, the author points out many examples of how English punctuation and typesetting conventions threaten to override correct Spanish practice, for example, in the use of spaces and hair-spaces, hyphens, n-dashes and m-dashes, the placement of punctuation inside or outside double or single quotes, and the correct characters to use for accents, primes, quotes and apostrophes. The proliferation of these errors is apparently an undesired side-effect of the spread of word processing and typesetting software with default settings for English usage—which in some cases cannot be altered.

No index is included, but navigating is made easy by the detailed and carefully laid-out table of contents, the list of charts and tables, and the many clearly marked cross-references. Reading the author’s advice on how to use the book (a part we are so often too impatient to bother consulting) will ensure that no matter how abstruse the topic may be, the user will find it with little difficulty.

Copyeditors and production editors working in Spanish will find the manual easier to use than will writers. Entries are often long and detailed, and over the many points on which different authorities disagree, Martínez de Sousa shows flexibility in explaining the alternatives currently in use. According to the author, users have the right to know which of the current recommendations by the Real Academia de la Lengua Española are not considered acceptable by prestigious philologists and editors who do not support some of this institution’s recent decisions on spelling, grammar, accentuation and terms for the international system of units. On points where a given option has been widely accepted, Martínez de Sousa makes it clear which standard is to be followed. However, on points for which there remains widespread and justified noncompliance with the “official” standard, he carefully explains the advantages and disadvantages of each option. Authors, editors and publishers must then make up their own mind which path to follow, and develop their own personal or institutional style guides. What Martínez de Sousa does is give users of the manual enough detailed information on controversial points so that they can make an informed choice. This is the best

academic style manual available for contemporary Spanish as it is used in Spain; editors and publishers who work in Spanish cannot afford to be without it. Academic authors who wish to write, spell and punctuate Spanish correctly will find that this manual answers any question they might possibly have. Copyeditors and proofreaders who work with Spanish texts will find in this manual the definitive source for the fine points of usage.

Karen Shashok

Translator – Editorial Consultant, Granada



Orígenes. Del Big Bang al Tercer Milenio

ALFRED GINER SOROLLA,
MERCÈ PIQUERAS

2000. Editorial Antinea,
Vinaròs, Spain

264 pp. 23 × 16.5 cm
Price: 2400 PTA (14.5 ₤)

ISBN 84-89555-35-4

Tribes people have queried their origins and about the origins and the origins of their universe since time immemorial and we all tribes men and women. Once upon a time, humans believed themselves to be the highest form of life on Earth. Many still do. Religions differ styles with precise authority of their anthropocentrism—many leaders commanded sufficient authority to rail and front about human imperfections and sin. Nevertheless, in the past and still today man is looked upon as the most beloved creature of God. God is the creator of all things, live and alive. The admission that we humans are not at the summit of the entire biological universe has protracted and painful, an attack on the pride of chosen species: We are only one of tens of millions species inhabiting our planet back of them probably consider himself chosen as well.

Orígenes offers us intellectual tools for the calmed consideration of the eternal questions of how the universe and life began. The Greek philosophers who, observers of nature during a bright long period, generated fruitful ideas and thoughts are reviewed. The Middle Ages, less dark than we used to think, were predecessor to the great new ideas of the Renaissance. Our ancestors, in their quest to explain the origins and fate of our presence on Earth, found spirits who everywhere animated nature. In the Medieval Europe, the small world of the person, the microcosm, mirrored the macrocosm, the universe. Both were partially matter and spirit. The ancient worldview lingers

in the animals of the zodiac and in the astrological notion that celestial bodies influence mundane ones. Johannes Kepler, who in the 17th century calculated that planets travel around the Sun in ellipses, believed that the stars inhabit a three-kilometer thick shell beyond this solar system. Earth to him breathes and forms habits. His approach reminds us that science is asymptotic; one knowledge never arrives at—it only approaches the tantalizing final goal. Astrology gave way to astronomy: alchemy evolved to be chemistry. The science of one age generates the myths of the next. Dare we imagine how will future thinkers assess our own ideas?

In *Origenes*, we read the life's exuberance of diversity and its evolution. The intellectual thread of creationism, esotericism and other doctrinal "truths" is traced. How so many people attracted to doctrines for which no evidence is forthcoming and how they are assuaged by a sort of security is detailed. In the same way that a weakened body is unable to resist bacterial infections, a depressed people is vulnerable to easy explanation and promise of spiritual comfort. The rejection of whole-cloth mysteries in science requires us to abandon the successive anthropocentric and geocentric doctrines. We eschew both "mechanism" and "animism" as explanations of life. Life, as an emergent behavior of matter, is best explored by investigative science.

Life, as far as is known, is limited to the surface of this planet. Moreover, living matter utterly depends on the sun, a medium-sized star in the outback of the Milky Way galaxy. Not even one percent of the solar energy that strikes Earth is diverted to living processes. But what life does with that one percent is astounding. Genes and offspring are made from water, solar energy, and air. Transformed and polluted, slaughtered and nurtured, threaten, the survivors succumb or overcome. Meanwhile, the biosphere itself, subtly changing with the comings and goings of individual species, has persisted for over 3500 million years. Although they exchange a great variety of material and communicate a huge quantity of information, all living beings ultimately share a common past. Life, from bacterium to biosphere, maintains by repair and reproduction. It is a mash of making more of itself. The insight of James D Watson and Francis Crick of how DNA works may be the greatest scientific breakthrough in history. Nonetheless, neither DNA nor any kind of molecule can, by itself, explain life.

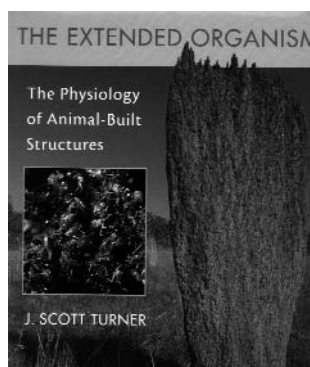
Origenes is not limited to the past. Today, it claims, the enigmatic question of humans is related to the possibility of other forms of life in the universe. The exploration of planets that include knowledge of the atmospheric conditions on Mars forces new questions. Does life exist on Mars? The Viking Mission in 1975 sent two orbits and two landers there, to perform a series of experiments. They failed to find any evidence of life. Prior to the Viking launch, James E. Lovelock had provided evidence for the absence of life on Mars, from the study of the chemical constituents of Martian atmosphere. Lovelock show how the data were already sufficient to

determine that Mars is not a living planet. Based on the reasoning of the Gaia hypothesis, he showed that Mars is devoid of life. Ecoopoiesis and autopoiesis respectively refer to the appearance and maintenance of ecosystems and cells through perpetual metabolism and chemical activity. Autopoiesis self-maintenance requires energy expenditure and the making of messes. Autopoiesis is detected by incessant life chemistry and energy flow which is metabolism. Only cells, organisms made by cells, and biospheres composed of organisms metabolize and are autopoietic. The autopoietic view of life differs from standard teaching in biology. Most texts imply that organisms exist apart from their environment and that the environment is primarily a static non-living backdrop of life. In *Origenes*, fundamental evidence is mustered to support concepts of intrinsic relationship and interdependencies of all organisms with environments. Since life's origin, all living beings have been connected through space and time. In its dawn, Earth was in the violent red throes of its beginning. Gravitational implosion of molten rock, heavy metal and swirling gases pervade near-Earth space. At the beginning of a new millennium we know more and more about the drama that has driven life and Universe. But nature continues to astonish and challenge the human intellect and its machinate and electronic products. In *Origenes*, the authors recognize that scientific results are unlikely to answer all questions and solve all enigmas. Their thesis is that scientists and teachers be stimulated to arouse the curiosity and the ability of everyone else to formulate any answerable question.

Lynn Margulis¹ and Carmen Chica²

¹University of Massachusetts-Amherst

²INTERNATIONAL MICROBIOLOGY



The Extended Organism: The Physiology of Animal-Built Structures

J. SCOTT TURNER

2000. Harvard University Press, Cambridge,

Massachusetts, USA

235 pp. 24 × 21.5 cm. Price: US\$ 47.50. ISBN 0-674-000151-6

J. Scott Turner's *The Extended Organism: The Physiology of Animal-Built Structures* is worthwhile reading for those with a "natural history" interest in amazing animal antics. For those with a penchant for thinking about the ways in which we think, it is also a good read. Exploring the intricacies of how silken webs of diving spiders and aquatic cocoons of weavers serve as

accessory lungs and gills and crawling the complex acoustical structures crickets build for symphonic amplification are worthy pursuits in themselves. Turner uses these, and many other examples, to support the argument of his book: traditional ways of identifying organisms' boundaries are too confining. That there is "... an 'external physiology,' which results from adaptive modification of the environment. ..." is his central thesis, as expressed in the following sentence: "By structurally modifying the environment, ... organisms manipulate and adaptively modify the ways energy and matter flow through the environment. In so doing, they modify the ways energy and matter flow through them." A physiological ecologist who specializes in termites, Turner is at his best when illustrating cases of the blurry physiological and logical boundaries of animals, animal-built structures and the environment. Although dealing with familiar examples, Turner is first-rate in his chapter on social insects, *The Soul of the Superorganism*. His architectural analysis and description of nest-environment interactions of *Macrotermes* is both clear and elegant.

In asking the reader to recognize, or at least to entertain, that internal/external boundaries are more than skin deep, Turner intends to interrogate the pervasive reductionism, the erasure of the organism, from reigning molecular and neo-Darwinist biologies. The central philosophical argument of the book is that: "The concept of the extended phenotype offers one way to bridge the divide between the two biologies." There is, perhaps, some irony in wishing molecular biologists and neo-Darwinists to get a new 'feeling for the organism' through an amplification of Richard Dawkin's concept of extended phenotype. It is a down-the-rabbit-hole fantasy that organism (phenotypic vehicle) and artifact (phenotypic tool) in the service of replicators will function as philosophic bridge to an holistic, and, what Turner ultimately argues, a Gaian, world-view.

Turner presents examples of animals who "benefit" by capitalizing on external energy gradients and saving an "investment" in metabolic energy. Grounding his 'new' holistic view in the concept of the extended phenotype, using economic (cost-benefit) and mechanistic metaphors, subverts Turner's own industrious transgression of reductionist dogma. Turner bravely struggles for a new, uncommon, language. But the muddle of conceptual metaphors in the text speaks loudly to the "trained incapacities" induced by neo-Darwinist socio-babble. Turning to cybernetic fixed-point black-boxing does not facilitate seeing in new ways or thinking in new ways, as Turner summons us to do. The splendid intention of Turner's argument is undercut in other ways. Away from his areas of expertise, there are many unsettling errors—for example, photosynthesis is equated with oxygen production; the dates he gives us for Earth history events are significantly off the mark. Although citations in practice

are thin in 'trade' books, I felt an uncomfortable longing for them; an unease reinforced by a search through chapter sources, labelled *Readings*, at the back of the book. Turner should be forgiven for these errors; in some ways, they can be seen as form/content example of what he critiques—the trained incapacities induced through academic specialization.

The final chapter, *Love Your Mother*, is the theoretical climax of the work. Here Turner argues for an early version of Lovelock's Gaia hypothesis. He combines engineering systems-theory black boxes with a rather odd definition of symbiosis to argue that substantial "benefits" accrue to biota through homeostasis and that "... the physical environment must be drawn into a physiological conspiracy, so to speak, that will confer homeostasis not only upon the organisms in the environment but upon the environment itself." After a ramble through negative feedback, and energetic fitness, we are enjoined to a "new" concept he names "telesymbiosis"—symbiosis at a distance. That organisms modulate their environments in powerful ways, well beyond their envelopes, is not a shock to readers aware of the metabolic depth and breadth of the microbial world. Recognizing that biota alter the faces and flows of the Earth system in powerful ways, that, in a sense, they catalyze reactions and change the rates of those reactions is, indeed, an important and "big idea." Recognizing microbial metabolism as a planetary phenomenon and thus, in a very real sense, that there is a *planetary physiology* does provide the grounding for a new, holistic scientific world-view. Whether this is grounds to call Earth a superorganism is more a matter of aesthetic taste and tradition.

A reader even marginally conversant with Gaia theory, with symbiosis and symbiogenesis, may well find this culminating chapter irritating. Turner has not familiarized himself even in a cursory way with the existing literature while laying claim to a "radical" transforming vision. "Telesymbiosis" is a totally unnecessary term, a misleading concept as part of 'scientific' discourse. Nevertheless, Turner's intuitive grasp of what is 'wrong with the picture' created by mainstream neo-Darwinist and molecular thought and his reach toward a shift to critical holistic thinking must be appreciated. That many animal-built structures should, indeed, be understood to modify flows of matter and energy through the environment and thus participate in "...a physiology that extends well beyond their conventionally defined boundaries..." is skillfully demonstrated through the examples of *The Extended Organism*. It is befitting to applaud a zoologist bringing fauna to the fore, explicitly recognizing environment as adaptive—adapted by life for life.

Lois Brynes

Deep-Time Associates, Rockport, MA