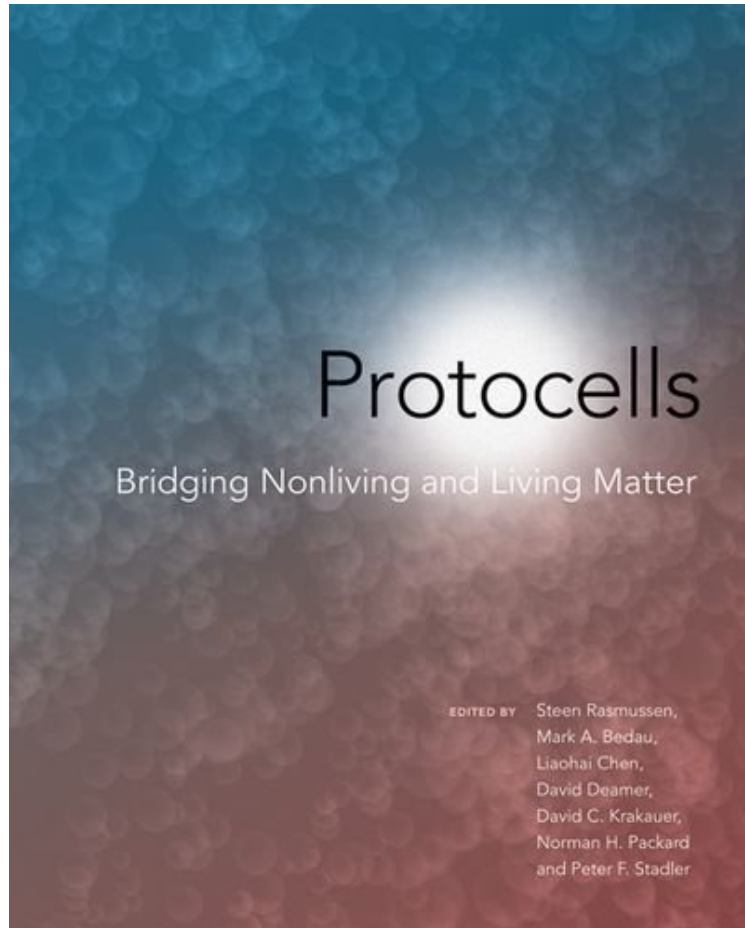


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Protocells: Bridging Nonliving and Living Matter (MIT Press)

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From The MIT Press : Protocells: Bridging Nonliving and Living Matter (MIT Press) before purchasing it in order to gage whether or not it would be worth my time, and all praised Protocells: Bridging Nonliving and Living Matter (MIT Press):

0 of 0 people found the following review helpful. some chapters are better than othersBy PhiloAn anthology of papers on protocells, some chapters are better than others, of course. As a layman, I found some papers too technical to understand, but there are certainly some that were just what I was looking for, given my interest in origin of life research. The chapters by David Deamer on Experimental Approaches to Fabricating Artificial Life, and P Stano, G Murtas, and P Luisi's chapter on Semisynthetic Minimal Cells were great. I particularly liked the discussions of the "minimal genome".1 of 1 people found the following review helpful. Detective Work to Solve a 3+ Billion Year-Old Event---a Teacher ReviewBy John Richard Schrock: Protocells: Bridging Nonliving and Living Matter edited by Steen Rasmussen, et al.; MIT Press, 2009; hardcover, 684 pages. How did the first complex chemistry replicate and grow into Earth's first life? What was the nature of the first cell that possessed the properties of life and gave rise to all that is

living today? This book gives a snapshot of the state of the art in research on protocells circa 2009. Creationists have many objections to evolution and one of them is the common textbook explication of the Oparin-Haldane Hypothesis and early work by Stanley Miller under Howard Urey. For the secondary or university biology teacher who needs more than is in the biology textbook to bring that old research up-to-date, there are a few sections of this book that are accessible to the non-PhD. However, with public science literacy nosediving and the complexity of modern science skyrocketing, this book is a far reach for anyone not trained in college-level biology at the graduate level. There are 28 chapters arranged in sections. The first four chapters provide an overview and history. The second section addresses integration in the context of assembly and includes chapters 5 through 12. The next section is on components, and chapters 13 through 28 tackle discrete problems including ethical implications. The introduction discusses the bottom-up approach that focuses on assembling a minimal protocells from simple inorganic and organic components as well as the top-down approach that focuses on the simplification of modern cells with the anticipation that they will someday meet in the middle. The biology teacher who is accustomed to the Oparin-Haldane and Stanley Miller stories will be surprised to find Haldane only quoted 3 times and Stanley is never mentioned. Oparin's work is cited many times, especially in the historical work leading up to modern experiments. Simply, work on chemical evolution has moved on to far more complex experiments and left the current biology textbook examples far behind. Each chapter ends with an extensive list of references addressing the chapter. The early history of protocells traces back to Alfonso L. Herreras 1897 search for the origin of protoplasm and its chemical basis, barely out of the shadow of vitalism. Then the biochemist de Jong works with colloids and coacervates to explain the properties of protoplasm, work that is picked up by Oparin. In the 1930s, a Cleveland physician Crile attempted to produce artificial cells from living tissue. Sidney Fox and others produced microspheres. And a researcher from the University of Allahabad attempted to synthesize protocells although the evidence in his publications was inadequate to replicate; such detection of foreign work is unexpected in western science literature. Chapter 2 continues the documentation of attempts to fabricate artificial cells. Here the focus changes to membranes and growth processes. Separating the organization inside a cell from the chaos outside provides an appreciation for the environmental constraints on simple systems. There is also the concurrent need to encapsulate the transcription and translation systems. The reader here will face a summary of the need to self-assemble into bilayer boundary structures and encapsulate polymers that are being synthesized.... If this makes sense to a reader, then read on. Chapter 3 looks at what is required of semisynthetic minimal cells; that is, what is the least that life can get by with? Of course, this will be where the RNA World concept is discussed where the chicken-or-the-egg problem of which came first: the code or the enzyme to replicate the code, and of course the answer is that the RNA cell consists of a vesicle containing two ribozymes, one with replicase activity, the other being a catalyst for the synthesis of the membrane component.... Further discussion asks what is the minimal genome necessary. The author contends that significantly greater control of molecular reactions without compartments has been achieved in the past few years, allowing a realistic approach to simple cell models. Chapter 4 lays out a roadmap to protocells and proposes there are three functionalities: replicating genes, metabolism, and the reproducing container. Functional diagrams are used to suggest the various schemes for deducing experiments including: the chemoton, the RNA cell, the Los Alamos bug, the protein/DNA cell, etc. The Chapter 5 on synthetic protocells is of interest to teachers who will be unaware that in addition to DNA and RNA, there is also a TNA (threose nucleic acid) and a GNA (glycerol nucleic acid). Most effort has gone to RNA replicase models. To a biology teacher, the question of whether fatty acids are the right membrane material for protocells will seem strange, but there are many options pursued here. This includes the possible role of clay particles. No less than 23 authors put together chapter 6 on assembly of a minimal protocell and it is a much longer chapter and will require extensive chemistry knowledge to fully comprehend: photofragmentation, Ru-bpy sensitizer scheme, organic sensitizer scheme, amphiphilic gene replication, PNA Template-directed ligation and replication, etc. Chapter 7 considers the evolutionary route of liposomes-with-protein-synthesis, the direction pursued by four Japanese authors. This is followed by theory and experiments on a constructive approach to protocells by another Japanese researcher who focuses on statistical laws. The Origin of Life and Lattice Artificial Chemistry follows similar lines. Chapter 10 on Models of Protocell Replication pursues self-replication spots, nanoscale replicating aggregates, simulations of vesicle fission, mechanochemical approximations, spontaneous division and induced division. Two authors address Compositional Lipid Protocells: Reproduction without Polynucleotides in Chapter 11. One author discusses Evolutionary Microfluidic Complementation Toward Artificial Cells in a long Chapter 12. The third major section on components begins with Chapter 13 on Self-replication and Autocatalysis. This is the midway point in this well-bound book and the 22 color plates on quality paper provide color illustrations for the whole book. Chapter 14 discusses Replicator Dynamics in Protocells. The biologist concerned less with theory and models and more with possible chemical evolution will appreciate Chapter 15 on Peptide Nucleic Acids as Prebiotic and Abiotic Genetic Material. Again, peptide nucleic acids (PNA) will seem a strange partner of our familiar DNA and RNA, and it also has a helical structure. Chapter 16 on The Core of a Minimal Gene Set; Insights from Natural Reduced Genomes will be of interest to biology teachers since it compares the size of the genomes of minimalist life forms such as mycoplasmas. However, the authors consider it a conceptual tool more than an indication of the original protocell on Earth. Parasitism and Protocells: Tragedy of the Molecular

Commons is Chapter 17 and discusses the evolution of cellularization driven by parasitism. Chapter 18 on Forming the Essential Template for Life: The Physics of Lipid Self-Assembly strives to derive self-assembly from the four essentials for life: amino acids, nucleotides, carbohydrates and fatty acids. Discussion extends to micelles, bilayers, closed vesicles and lipid vesicles. Numerical Methods for Protocell Simulations is heavily mathematical and deals with Brownian and dissipative particle dynamics, gas molecular dynamics, and chemical kinetics, etc. Core Metabolism as a Self-Organized System is Chapter 20 and is also a statistical treatment. Chapter 21 on Energetics, Energy Flow, and Scaling in Life includes a Figure 21.2 useful to teachers, showing a log-log plot of metabolic power versus biomass. The final section on the broader context includes: Chapter 22 on Gant's Chemoton Model and Life Criteria and a figure 22.5 where the units of life satisfying absolute life criteria are narrower than the units of evolution satisfying potential life criteria. Chapter 23 discusses Viral Individuality and Limitations of the Life Concept. Many students make the mistake of believing that virus simplicity places them as an early life form. However, the majority of novelties were genetically plagiarized from host genomes and, in many cases, remain resident in the host genome and exploited through spatial propinquity following infection. In other words, they are reduced chemical runaways from their hosts, not an intermediate in life. While it is possible RNA viruses could have independent origins, they are likely of cellular origin. Nonlinear Chemical Dynamics and the Origin of Life: The Inorganic-Physical Chemist Point of View is Chapter 24. Chapter 25 discusses Early Ancestors of Existing Cells. Prebiotic Chemistry, the Primordial Replicator, and Modern Protocells is Chapter 26 and focuses on the early chemical evolution. Chapter 27 on Cell-like Entities: Scientific Challenges and Future Applications returns to the problem of defining life and non-living systems. Figure 27.1 provides a usable illustration of the continuum from nonliving minerals to eukaryotes, with dependent living in the middle. This leads to the final chapter on Social and Ethical Issues Concerning Protocells which discusses pure science, medical applications, and the bioterrorism dangers of reproducing nanotechnology. A 11-page glossary, 12-pages of author biographies, and 6-pages of an index in small type conclude the book. Again, this is a book for graduate-level biologists but in the few cases noted above, there are figures and some descriptions that are useful to a biology teacher at lower school levels.

The first comprehensive general resource on state-of-the-art protocell research, describing current approaches to making new forms of life from scratch in the laboratory. Protocells offers a comprehensive resource on current attempts to create simple forms of life from scratch in the laboratory. These minimal versions of cells, known as protocells, are entities with lifelike properties created from nonliving materials, and the book provides in-depth investigations of processes at the interface between nonliving and living matter. Chapters by experts in the field put this state-of-the-art research in the context of theory, laboratory work, and computer simulations on the components and properties of protocells. The book also provides perspectives on research in related areas and such broader societal issues as commercial applications and ethical considerations. The book covers all major scientific approaches to creating minimal life, both in the laboratory and in simulation. It emphasizes the bottom-up view of physicists, chemists, and material scientists but also includes the molecular biologists' top-down approach and the origin-of-life perspective. The capacity to engineer living technology could have an enormous socioeconomic impact and could bring both good and ill. Protocells promises to be the essential reference for research on bottom-up assembly of life and living technology for years to come. It is written to be both resource and inspiration for scientists working in this exciting and important field and a definitive text for the interested layman.

To create life from scratch is the ultimate goal of origin of life research and one of the great scientific challenges of 21st century. A program to synthesize wet artificial life was initiated by a group of scholars in 2000. This collective volume presents a fascinating progress report and sketches the paths that eventually will lead to an artificial cell. Life has many features the most basic of them are compartmentalization metabolism autopoiesis multiplication and inheritable encoded information. The volume covers the state of the art in all subdisciplines with excellent articles written by first rank scientists. To bring partial solutions together and to unite them in a great experiment is the task of the future. (Peter Schuster, University of Vienna) About the Author Oran R. Young is Professor and Codirector of the Program on Governance for Sustainable Development at the Bren School of Environmental Science and Management, University of California, Santa Barbara, and Chair of the Scientific Committee of the International Human Dimensions Programme on Global Environmental Change, sponsored by the International Council Of Science (ICSU), the International Social Science Council (ISSC), and the United Nations University (UNU). He is the author of The Institutional Dimensions of Environmental Change: Fit, Interplay, and Scale (2002) and coeditor (with Leslie A. King and Heike Schroeder) of Institutions and Environmental Change: Principal Findings, Applications, and Research Frontiers (2008), both published by the MIT Press. Steen Rasmussen is Scientific Team Leader for Self-Organizing Systems at Los Alamos National Laboratory and Professor of Physics at the Center for Fundamental Living Technologies at the University of Southern Denmark. Mark A. Bedau is Professor of Philosophy and Humanities at Reed College, editor-in-chief of the journal Artificial Life, and cofounder and COO of ProtoLife Srl. He is and the coeditor of Emergence: Contemporary Readings in Philosophy and Science (MIT Press, 2008). Liaohai Chen is a

molecular biologist and Group Leader in the Biosciences Division at Argonne National Laboratory and Associate Professor at Rush University Medical Center, Chicago. David Deamer is Research Professor of Chemistry and Biochemistry at the University of California, Santa Cruz. David C. Krakauer is Research Professor at the Santa Fe Institute. Norman H. Packard is cofounder and CEO of ProtoLife Srl. Peter F. Stadler is Professor of Bioinformatics at the University of Leipzig. Rasmussen, Packard, and Stadler are External Research Professors at the Santa Fe Institute. David Deamer is Research Professor of Chemistry and Biochemistry at the University of California, Santa Cruz. David C. Krakauer is Research Professor at the Santa Fe Institute. Peter F. Stadler is Professor of Bioinformatics at the University of Leipzig and an External Research Professor at the Santa Fe Institute. Liaohai Chen is a molecular biologist and Group Leader in the Biosciences Division at Argonne National Laboratory and Associate Professor at Rush University Medical Center, Chicago.