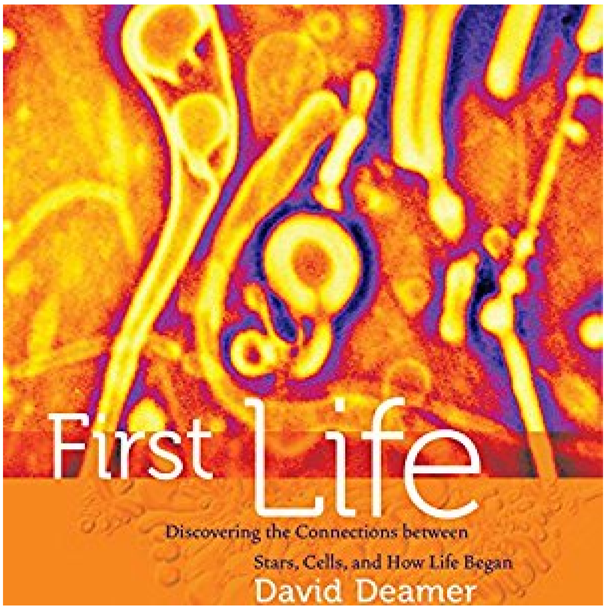
# First Life: Discovering The Connections Between Stars, Cells, And How Life Began



## Synopsis

This pathbreaking book explores how life can begin, taking us from cosmic clouds of stardust, to volcanoes on Earth, to the modern chemistry laboratory. Seeking to understand life's connection to the stars, David Deamer introduces astrobiology, a new scientific discipline that studies the origin and evolution of life on Earth and relates it to the birth and death of stars, planet formation, interfaces between minerals, water, and atmosphere, and the physics and chemistry of carbon compounds. Deamer argues that life began as systems of molecules that assembled into membrane-bound packages. These in turn provided an essential compartment in which more complex molecules assumed new functions required for the origin of life and the beginning of evolution. Deamer takes us from the vivid and unpromising chaos of the Earth four billion years ago up to the present and his own laboratory, where he contemplates the prospects for generating synthetic life. Engaging and accessible, First Life describes the scientific story of astrobiology while presenting a fascinating hypothesis to explain the origin of life. The book is published by University of California Press.

## Book Information

Audible Audio Edition
Listening Length: 13 hoursÃ Â andÃ Â 57 minutes
Program Type: Audiobook
Version: Unabridged
Publisher: University Press Audiobooks
Audible.com Release Date: December 3, 2012
Whispersync for Voice: Ready
Language: English
ASIN: B00AHAY8Y2
Best Sellers Rank: #73 inÃ Â Books > Audible Audiobooks > Science > Astronomy #524 inÃ Â Books > Audible Audiobooks > Nonfiction > Nature #1836 inÃ Â Books > Science & Math > Earth Sciences > Geology

## Customer Reviews

By far the best book on the origin of life for non-scientists. I have read most of what's out there, and Dr Deamer does the best job of explaining the basic requirements for a functioning cell to arise de novo. Building up from basic chemistry and biochemistry, he gradually introduces the reader to more technical concepts and ideas. Broad in scope, he covers all the important components, from lipid bilayer compartmentalization to polymerization of basic ingredients into proteins, nucleic acids and carbohydrates, to conjectures on ways that energy systems could generate order and drive reactions, catalysts form, information coded and copied and the entire protocell divide and evolve. Along with Geoffrey Zubay's Origins of Life, this book will give the reader a great head start in understanding the difficulties and challenges yet ahead in origins of life research, as well as some of the proposed answers. Deamer is an active researcher in the field, and his writing style is very clear and easy to read. While he presents his own theories on how life arose, he also touches on the hydrothermal vent theory popularized by Nick Lane.

Great job listing the current questions, exploring known and possible answers to them and tracing promising research paths.It is always positive when you finish a book with more questions than you had before. Life is complex even to define it, let alone to create hypotheses about how first molecular systems started interacting, what were their constituents and neighboring environment attributes, how they acquired the ability to compete for environment resources and lead us all living creatures into this amazing journey we call evolution.Another bonus: although the book's central theme is linked to strong religious beliefs for significant part of human societies, the author kept the narrative as far as possible from religion.5 stars for Deamer and the rest of the crew.

Like the best scientists, David Deamer uses what we know to open the doors to what we don't know and should want to know. Of course, most of us don't know what he presents in this book about how molecules void of life can form the precursor forms of life and the simplest life forms under conditions as different as the surface of Mars, the deep ocean vents, and glacial ice.

An engagingly written book about the theories of how life originated on Earth and the scientific efforts to unravel this incredible mystery. Although at times, it can be a bit technical for the layperson, it's still a very interesting read. You never know when the next page will hit you with an "I didn't know that!" revelation.

Dr. Deamer does a great job presenting the issues confronting those who are trying to determine how first life appeared.

As a none scientist I am struggling to get through the book but it is written in a way that I can understand it.

**I read Andreas Wagner's Arrival, John Tyler Bonner's Randomness in Evolution, and David Deamer's First Life: Discovering the Connections between Stars, Cells, and How Life Began subsequently, so my review is meant to be read relative to the other two as all three overlap in subject matter. (This paragraph appears in all three reviews). I am reading these books after reading several on cosmology.* I wanted to move beyond what cosmologists say (with disagreement) about the formation of the universe to see how it could be compatible with what chemists and biologists say about the beginning of life. Alan Lightman writes in the Accidental Universe that "Science can never know how universe was created," and I find that to be echoed in these books -- science can never know or prove how exactly life began (Deamer states this outright). Exactly what chemicals were available on earth to mix in what quantities to randomly create a reaction between molecules that led bonds to form, information to be transmitted, and growth to begin? All of the hypotheses presented in the books require certain laws of physics and nature to hold but I have not found any who attempts to explain how those laws arose in the first place. Why are these laws what they are? Call this the Paul Davies critique. http://www.nytimes.com/2007/11/24/opinion/24davies.html?_r=0Deamer acknowledges that it's possible a creator put those laws into existence, but the other two avoid the subject. None of the three seem to recognize that chance is not a causal force, so time + chance cannot explain anything.Where did light come from and how did it contain information? How did cells know that it contained information and figure out a way to receive and decode it? How do "regulator cells" operate according to these laws? What is consciousness and at what point is life "life" such that it has "value?" All three of the authors reach the same conclusion as the cosmologists above-- we are a random collection of atoms that will one day be scattered, nothing more nothing less. Life has no meaning outside of a debatable definition regarding complex molecular processes, and any sentiment we attach to it is illogical-- there is no soul in science. I do not, therefore, understand how Lightman, Hawking, Richard Dawkins, etc. can argue that scattering people's atoms is "wrong," or where they get ethics. We're not special, only lucky in the sense of randomness.These three biochemist authors, however, engage in less armchair philosophy than Hawking et al, and (unlike string theorists Hawking and Green) argue that science requires testable hypotheses and that the universe had a beginning. Each of these books have a good look at what actual laboratory research looks like. These are not just men working equations at a desk all day, although there is some of that. They're often out traveling the world in search of mineral samples and in the laboratory mixing chemicals in the search for the genesis of life. My next set of books will be on the scientific understanding of consciousness-- something these books do not address.**http://www.chemistry.ucsc.edu/faculty/singleton.php?&singleton=true&cruz_id=dwdeamer Deamer is a biochemist/astrobiologist whose "primary research area concerns the manner in which linear macromolecules traverse nanoscopic channels...A second line of research concerns molecular self-assembly processes related to the structure and function of biological membranes, and particularly the origin and evolution of membrane structure" (from his UCSC profile). Astrobiology was fueled partly by NASA’s discovery in 1996 that the Allan Hills asteroid from Mars contained fossils of bacteria-like lifeforms. Other meteorites having contained amino acids, suggesting that the basic building blocks of life could have arrived to earth from outer space some 4.35-4.7 billion years ago.https://en.wikipedia.org/wiki/Allan_Hills_84001But can biological life arise from non-biological processes? Can the right combination of chemicals, heat, electricity, etc. generate reactions where molecules bond, feed off available food sources, reproduce themselves, and form complex structures that eventually develop into "life?" That is the key question, and Deamer is betting on "yes," without asking where these basic building blocks and the laws of physics that formed them came from. (He admits in the epilogue that the laws of the universe could have been put in place by a "creator"). But the book does a great job showing what biochemists do. If I knew someone who was thinking about majoring in chemistry or biology, I would give them this book. Deamer travels the globe collecting samples, runs tests in labs, analyzes others’ discoveries, and hypothesizes what resources would be needed for the next breakthroughs in this field. I found it thoroughly enjoyable as a layman who had only read other similar books (see above). There is much tedious chemistry in the book, with precise chains given. That makes it a bit tough for the layreader, but I appreciated Deamer’s thoroughness."Emergence" is the complexity that arises over time it cannot be predicted or explained. Life is not a universally-defined term, so in order to create artificial "life" you have to first have a definition they do have some agreement on what is required for life-- for Deamer this appears to be metabolic processes occuring in cells with polymers. Life is based on six elements. Deamer states outright that science can never prove how life began since it would be impossible to know or simulate the exact conditions that occurred on earth. We’re only now learning what materials were available, and multiple hypotheses abound. One criticism Deamer has of modern research is that too much emphasis is put on isolated experiments using very few chemicals in highly-controlled environments, something that definitely would not have been earth 4+ billion years ago. But Deamer fails to address more serious criticisms of chemical evolution, even from biologists like Bonner who argue that short shrift is given to randomness. http://www.discovery.org/a/24041 See the list on Discovery.org of the Top Ten Scientific Problems iwth biological and Chemical Evolution.The accepted age for the universe is 13.7 billion years ago, which means we are just now seeing stars reach the end of their life and go supernova. Our solar system is about 13.2 billion years old, and planet earth is supposedly 4.5 billion years old. Samples of zircon have tested older than 4.4 billion years old, with some (debated) tests intpreted to show that there was already water on the earth at that time. It’s at around 4.35 billion years that the environmental conditions necessary for life to begin are believed to have first existed, but life "can’t be older than 3.8 billion years" and is "improbable" before 3.5 billion years ago according to Deamer, which is the age of the earliest fossils. It’s possible that life existed prior to that time but a "late bombardment period" of asteroids about 4 billion years ago could have killed whatever life had existed, and changed the mix of chemicals and conditions present.10% of the water in oceans is believed to come from asteroids, which could also have brought cosmic space dust containing amino acids and other building block-like materials along with comets that brought organic carbon in some amount. Deamer writes that Miller’s experiments in 1953 found that amino acids themselves can be synthesized by non-biological processes, while also noting the conditions they used likely did not occur on earth at the time. Was the "site of origin" hot or icy? Deamer examines hypotheses for both, along with various hypotheses that have been disproven or still hold up over years of experimenting, like the Schauzer hypothesis about arsenic. Deamer often invokes Occam’s razor, the simplest solution is assumed to be the likely one, and often times that solution is "chance."Evolution had to occur before life-- molecules had to develop in such a way to bond better and reproduce. Hydrogen bonding is fundamental to life, but how did this happen spontaneously? What energy is needed to cause chemical compounds to change over time? Deamer writes that opposite of the law of entropy, chemical reactions always move from disequilibrium to equilibrium. This gets back to the Bonner book on randomness in evolution-- chance interactions and mutations occur, and no one stops to ask how all of these building blocks came to exist in the first place.One breakthrough for Deamer was the discovery that long chemical chains were not required for stable membranes. Life on the early earth was less tidy than a sterilized laboratory, so there had to be some way for chemicals to mix relatively protected. He presents the "Bubble Model" that membranes could have formed protective boundaries in which chemicals could mix, the same function test tubes perform today. There is a helpful summary of multiple variations on the bubble theory in a 1993 NY Times piece by John Wilford. These are "only guesses" according to Deamer. http://www.nytimes.com/1993/07/06/science/bubbles-may-have-speeded-life-s-origins-on-earth.html?pagewanted=1Eventually complex chains were formed, which begs the question of the minimum complexity needed to call it "life." There are plenty of unanswered questions, the joy of science.

Deamer explains the importance of the double helix and how it was hypothesized (never proven, but it fits in models well). The double helix is the only known way for a molecule to transmit a copy of itself. The author addresses several hypotheses regarding RNA and an "RNA World," which seems "too complex" to have been the first catalyst for life, it needs help. From here, Deamer delves more into biology.Darwin and others have proposed various "trees of evolution," which have now grown so complex as to be only readily organized by a computer. One important discovery in biology has been that of horizontal gene transfer (HGT), where a gene can be transmitted across organisms and not just vertically through offspring. This is an important factor in evolution and has led to a variety of experiments in genetic engineering to fight cancer and other diseases. Deamer cites a 1993 experiment involving RNA, random mutation, and natural selection that I have tried to read but not completely understand its implications.Chapter 14 rounds the book out with summaries on life-- all life is celluloid. Polymers are primary, and must exist before life. RNA does not have enough explanatory power, more prebiotic experiments are needed, etc. He proposes and calculates the cost for a simulator and dedicated laboratory to running the types of experiments he thinks are really necessary for breakthroughs within 5 years. (It seems relatively inexpensive compared to what we spend on everything else, perhaps someone in Silicon Valley would fund it.) Deamer believes that scientists will be able to fabricate artificial cells "in the next decade."The epilogue focuses on the intelligent design movement, stating his priors up front: Anthropology explains religion as evolving from the tribes relying on shared religious beliefs to have unity and survive. He does talk of the "flawed" and "illogical" nature of Behe’s irreducible complexity argument but does not explain how it’s illogical for the reader. He does somewhat address the improbable nature of the "cosmic soup" hypotheses and writes that the "soap bubble theory" of membraneous compartments increase the likelihood of the viability of chemical reactions. He cites a study that 36% of scientists believe in God and over half are "spiritual." Deamer actually agrees that the laws of nature and the universe could have been put in place by a creator. But notes that disagreements among biologists related to evolution are the mechanisms relating to "how," not "whether."I learned a great deal from this book and would love to read a critique of it. I would recommend it to anyone interested in chemical biology. It’s a bit difficult to get through if you’re not. 4 stars out of 5.

Printed Access Card for ... and Connections, 1st Edition, Multi-Term The Hoofs and Guns of the Storm: Chicago’s Civil War Connections (Great Lakes Connections: The Civil War) Caribbean Connections: The Dominican Republic (Caribbean Connections: Classroom Resources for Secondary Sch) How the New Art of Eurythmy Began: Lory Maier-Smits, The First Eurythmist Interactions Between Electromagnetic Fields and Cells (Applications of Communications Theory) Anatomy of the Soul: Surprising Connections Between Neuroscience and Spiritual Practices That Can Transform Your Life and Relationships Genealogy Basics In 30 Minutes: The quick guide to creating a family tree, building connections with relatives, and discovering the stories of your ancestors When Fish Got Feet, Sharks Got Teeth, and Bugs Began to Swarm: A Cartoon Prehistory of Life Long Before Dinosaurs Understanding Mali: Connections and Confrontations between the Tuareg, Islamist Rebels, and the Government Sexology: The Basis of Endocrinology and Criminology: The Surprising Connections Between Hormones, Imagination, Clairvoyance, and Crime From Page to Stage: How Theatre Designers Make Connections Between Scripts and Images Survival of the Sickest: The Surprising Connections Between Disease and Longevity (P.S.) Sex God: Exploring the Endless Connections Between Sexuality and Spirituality Maus : A Survivor’s Tale. I. My Father Bleeds History. II. And Here My Troubles Began Maus II: A Survivor’s Tale: And Here My Troubles Began (Pantheon Graphic Novels) Stars Between the Sun and Moon: One Woman’s Life in North Korea and Escape to Freedom