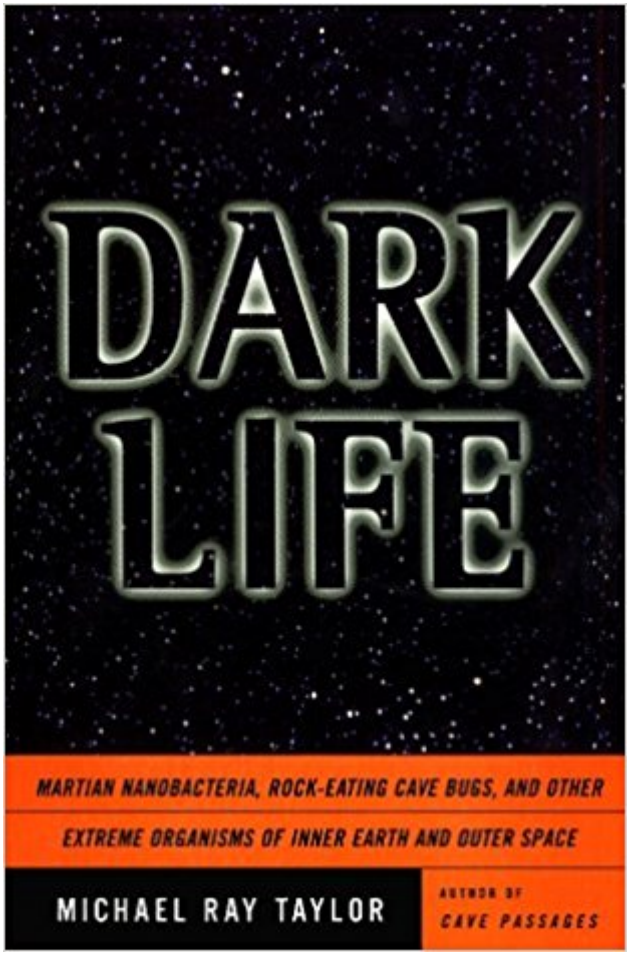
# Dark Life: Martian Nanobacteria, Rock-Eating Cave Bugs, And Other Extreme Organisms Of Inner Earth And Outer Space



## Synopsis

In a narrative that combines cutting-edge science with intense physical adventure, Dark Life tells the fascinating story of the quest to find life far underground and deep in space.  Able to thrive without sunlight or oxygen, dark life is a mass of subterranean bacteria that would likely tip the scale if weighed against all other living matter combined. Journalist Michael Ray Taylor takes us from Antarctic lakes to Hawaiian volcanoes to the satellites of Jupiter in search of these mysterious underground creatures that are redefining our understanding of evolution.  Taylor serves as a field assistant on several key scientific expeditions. He descends deep into New Mexico's tortuous Lechuguilla Cave and focuses powerful NASA microscopes on never-before-seen life-forms. He accompanies a young NASA intern who unknowingly kicks off a raging international scientific debate when she uncovers traces of dark life in a rock extracted from nearly two miles below Washington State -- traces that appear identical to the "micro-fossils" found in a Martian meteorite. He meets another scientist who has staked his reputation on using dark life to generate a cure for breast cancer. Throughout his adventures, Taylor gains unique insight into a growing controversy about the very definition of life itself -- an issue that scientists had long ago considered settled. Whether he is exploring the structures of a mysterious cell or reconnoitering tropical caves, Michael Ray Taylor is an adventurer for the new millennium.

## Book Information

Hardcover: 288 pages

Publisher: Scribner; 1st edition (April 9, 1999)

Language: English

ISBN-10: 0684841916

ISBN-13: 978-0684841915

Product Dimensions:  8.8 x 5.9 x 1.1 inches

Shipping Weight: 1 pounds (View shipping rates and policies)

Average Customer Review:  4.7 out of 5 stars  12 customer reviews

Best Sellers Rank: #3,264,595 in Books (See Top 100 in Books)  #83 inÃ  Â Books > Sports & Outdoors > Outdoor Recreation > Caving & Spelunking  #2758 inÃ  Â Books > Medical Books > Basic Sciences > Microbiology  #6942 inÃ  Â Books > Engineering & Transportation > Engineering > Civil & Environmental > Environmental

## Customer Reviews

The microbes that caver Michael Ray Taylor calls "dark life" are found deep in the earth, in boiling

oceanic vents, Antarctic ice, and lots of other places far from the reach of the sun's energy. These "extremophiles" are energy opportunists, subsisting on chemicals, radioactivity, or the faint light of molten rock. The study of these organisms is quite new, and scientists are learning that examining them may provide hints about the possibility of extraterrestrial life. Dark Life is a first-person tour of the places Taylor has looked for archaebacteria and other strange microorganisms--Lechuguilla Cave in New Mexico, the hot springs of Viterbo in central Italy, NASA laboratories, and the halls of academia. Taylor met with passionate scientists searching for answers about how things can live deep in the earth and if they can survive in the unimaginable cold of outer space while hitchhiking on meteors. Dark Life chronicles the triumphs and disappointments of this new field of science with engaging and personal stories. The steady but frustrating progress of science is never more apparent than in the passages relating to the rise and fall of ALH84001. The potato-sized meteorite from Mars (and the scientists who analyzed it) enjoyed brief but frenzied attention when it was announced that microscopic forms in the rock may have indicated the presence of nanobacteria. But if you're expecting resolution to this question in Dark Life, be warned: to Taylor, it's the journey that's most exciting. --Therese Littleton

The dark life of the title is made up of the masses of bacteria that live deep within the bowels of earth. Taylor (Cave Passages), a veteran caver and professor of communication and theater arts at Henderson State University in Arkansas, explains that these tiny organisms are so abundant that collectively they are thought to weigh more than all the aboveground biomass. Species as yet undiscovered by scientists are thought to abound and to be likely to shed insight into the origin of life. While of interest, none of this is particularly controversial. What is hotly debated is the size of the smallest of these life forms. Taylor argues in favor of the existence of nanobacteria, life so small that many scientists refuse to believe they are possible, contending instead that the patterns observed are due to chemical rather than biological processes. The debate is crucial because the fossils attributed to a rock from Mars are of this sortAif nanobacteria don't exist, traces of life have not been found on the red planet. Mixing science and adventure writing, Taylor describes fact-finding and collecting expeditions into uncharted caves. While he does a commendable job of vivifying the beauty of these strange environments and the passions of the scientists who study them, he is much less evenhanded when discussing the scientific controversy swirling around the nanobacteria themselves. Agent, Esther Newberg. 

This book documents journeys of discovery and transformation at several levels. It documents a

journalist’s personal journey from observer to active participant. It also serves as a chronicle of the journeys being taken by scientists all over (and underneath) the Earth and across our solar system to obtain an understanding of life’s amazing ability to exist and thrive in the most improbable places.The author starts out as a spelunking (cave exploring) science journalist and ends up as an active participant in the science he had originally set out to cover. In so doing he has provided an interesting mix of observer and participant perspectives. Being a seasoned cave explorer, the author is at home and adept at describing the techniques and hazards of natural laboratories such as Lechuguilla Cave located in New Mexico.Astrobiologists have found caves to be excellent laboratories for the extreme environments that may be found on other worlds such as Mars. Moreover, the amazing adaptations Earth life has made to these environments also serve as indicators of what is possible in terms of life’s ability to adapt - and may be indicative of what we might find underneath Mars. Getting around in these caves is not your run of the mill field trip. Sulfurous and caustic fumes, anoxic conditions, temperature extremes, risk of injury, and a myriad of other hazards all combine to make these explorations something that only skilled individuals should undertake. In so doing, the rewards to the risk takers are obvious - and are thoroughly documented by the author.There is much more to this book than crawling around stinky caves with excited astrobiologists. There is tedious work back at the lab, and the inevitable politics that accompanies academic life and government-sponsored research. Given that the discoveries being made about life in extreme environments are brushing aside long held views about biology, the politics can get rather nasty at times. The author provides a cogent description of what happens when the politics and dogma of science collide with new data and ideas. As you read this book you can almost hear the old paradigms crumbling as life’s very definitions get an overhaul.In describing some of the research done at NASA on the ALH84001 Martian meteorite, Taylor provides a classic description of paradigm crumbling - and the threat it can represent to the status quo. The events described surround the work of a student involved in a career-making discovery (possible fossils within a piece of Mars) and an advisor who disputes the findings and seeks to thwart her education at every turn.While not nearly as dramatic, the author describes many other situations wherein old accepted notions about what life is and where it can be found are challenged. As you travel around - and under - the world with Taylor, you learn about life at abyssal ocean depths, within rocks miles under the Earth’s surface, in the cold dry Antarctic, within volcanic deposits, and within highly radioactive environments. Such are the abodes of Earth’s so-called "extremophiles".If astrobiologists have learned anything in the past decade or so, it is that Earth life is capable of existing everywhere that it can theoretically exist. Since some of these "extreme environments" may

well pass for "normal" elsewhere in the solar system, the chances of finding life elsewhere start to become quite probable. It is that exciting prospect which is woven by the author throughout the fabric of this book.The author has gone to great physical extremes to write this book - and it shows. If you want a status report on how astrobiologists are using the Earth as a laboratory for what life may be possible on other worlds, this is it. Moreover, if you are looking for proof that science can still be a bona fide adventure in this Internet-shrunken world, then this book offers that as well.

_Dark Life_ by Michael Ray Taylor was a very interesting book. The author began it writing as a science journalist - having written a previous book on cave exploration as well has having articles published in such magazines as _Audubon_ - but over the course of the two and a half years he worked on this book went from becoming an observer to an active participant, a point he himself made several times in amazement and wonder. Originally he had set out to chronicle what was known about "dark life," microorganisms that dwell far underground or in the deep sea, organisms that derive their nourishment from sources independent of sunlight. These organisms, which have been found in such varied places as salt domes, Antarctic ice cores, and in highly acidic caves, have continually challenged notions of what life can tolerate, organisms so common that they may outnumber surface organisms (indeed Taylor rejected the commonly used term "extremophile" as he believes the term implies that these organisms are a "rare curiosity"). Taylor wrote of the history of the search for these microbes, the personalities involved, and where current research was in the field (as well as possible applications of this research). Somewhere along the way he became part of the story, as he became the friend and later colleague of several of the researchers he covered. While not a trained scientist per se, at least not in the field of microbiology, he assisted in and even proposed a number of experiments in the search for controversial nanobacteria (microbes with a size of less than 0.2 micrometers, once thought to be too small to be an independent functioning organism or at least too small for a prokaryotic organism, including known bacteria and archaea; not a virus) in a variety of environments, mostly notably Hot Springs National Park in Arkansas. By the end of the book he was regularly exchanging email with researchers, providing samples for them, and even had co-authored a few presentations at various seminars. Much of the book is focused on personalities - understandable given Taylor’s increasing personal involvement in the story himself - though mainly in the context of research on the topic at hand. The main characters (if you will) in the book were Larry Mallory (a scientist who had devoted his career to harvesting and culturing cave microbes in a promising search for a cure for cancer, particularly from microbes from the fascinating Lechuguilla Cave in New Mexico, an interesting place described in great detail in the book), Bob

Folk (a colorful scientist who discovered nanobacteria and their presence in a number of substances and had been in the lead in efforts to prove that microorganisms are vital in the formation of travertine in caves and hot springs as well as in some cases at least entire caves and cave systems), and Anne Taunton (an undergraduate student who as part of a NASA internship became embroiled in the efforts to determine whether or not the famed Martian meteorite ALH 84001 contained fossils of extraterrestrial nanobacteria). Others are followed to lesser degrees, among them Finnish nanobacteria expert E. Olavi Kajander, who had done pioneer work showing that nanobacteria may be the possible agents of many maladies such as kidney stones, Alzheimer's, and Mad Cow Disease that involve mineral precipitation in the body. In large measure these and other personalities faced considerable skepticism, criticism, and worse in their studies, as scientists found it hard to accept (in different instances) what was thought of as "impossibly" small bacteria, biological origins for various types of minerals and mineral formations, and the presence of microfossils in ALH 84001. Mallory had to leave his university because he was essentially denied tenure, the administration not believing his study of cave microorganisms important, Folk faced considerable criticism for suggesting that such substances as travertine owed their origins to bacteria, and Taunton (and the team she worked with) had a very difficult time with several scientists - including even her own undergraduate academic advisor - over efforts to demonstrate that the ALH 84001 microfossils were evidence of Martian life or even life of any kind. Although Taylor did a good job of showing the fact there was sometimes intense and even rather personal criticism in science, I don't know if he always showed why people had such a hard time accepting bold new theories. In particular some of the opposition to ALH 84001 fossils was quite heated. Though much of the focus was on personalities, politics, and the process of research the microbes were much discussed as well, many with bizarre biologies. Some cold-loving organisms were termed "psychrophiles," capable of growth below freezing, at -5 degrees Celsius, organisms that exhibit slower metabolisms at temperatures above freezing and death at anything approaching human body temperature (organisms that for years - like many other examples of dark life - proved difficult to study and culture in the lab). Some organisms found in apparently solid rock two miles deep, existing only on hydrogen and water, have unbelievably slow metabolisms, appearing to divide cells no more than once per century. Though many caves and indeed individual pools in caves produced unique microorganisms there were also astonishing similarities; the closest relatives to some sulfur-oxidizing thermophilic (heat-loving) bacteria from a cave in Kentucky were found to be a sulfur-oxidizing, symbiotic bacterium from a deep sea polychaeta worm, a relationship that has not yet been explained. At least as far as this reader is concerned Taylor made his case

that nanobacteria exist, that they are key in the formation of some minerals and many caves, and I am very open to the idea that ALH 84001 may indeed contain Martian microfossils. I enjoyed reading about the discussions scientists had about whether or not subsurface Antarctic lakes such as Lake Vostok and Jovian moon of Europa might have dark life and hope that both can be analyzed in the not too distant future.

Here is one of the must unusual and best-written scientific adventure stories I've read. Combining Richard Preston-style reportage with the loopy narrative structure of a Quentin Tarantino screenplay, Michael Ray Taylor writes with passion about a subject most of us expect to encounter only in a college classroom: microbiology. Far from being a textbook, Dark Life explores not only the cutting edge of "nanobacteria" research, but also tells the thrilling story of a journalist who becomes personally involved in the hunt not only for new forms of life under the Earth's surface ... but on other worlds, as well. The book should appeal to the adventurerer/traveler in everyone, as well as to hardcore science readers eager to get a glimpse at the future of microbiological research -- which could well lead us to exploration of the surface of Mars or one of the moons of Jupiter. With this book, Taylor has re-written the rules of science reporting, and put a new kink in the fabric of what we think of as traditional journalism.

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