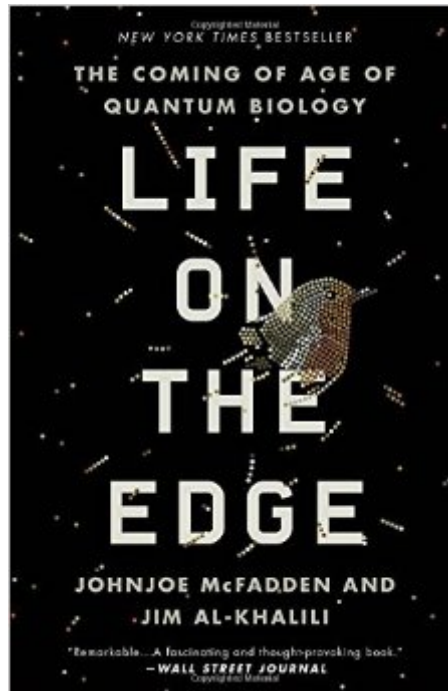




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Life On The Edge: The Coming Of Age Of Quantum Biology



Synopsis

New York Times Bestseller and an Best Science Book of 2015, *Life on the Edge* alters our understanding of our world's fundamental dynamics through the use of quantum mechanics. Life is the most extraordinary phenomenon in the known universe; but how did it come to be? Even in an age of cloning and artificial biology, the remarkable truth remains: nobody has ever made anything living entirely out of dead material. Life remains the only way to make life. Are we still missing a vital ingredient in its creation? Using first-hand experience at the cutting edge of science, Jim Al-Khalili and Johnjoe Macfadden reveal that missing ingredient to be quantum mechanics. Drawing on recent ground-breaking experiments around the world, each chapter in *Life on the Edge* illustrates one of life's puzzles: How do migrating birds know where to go? How do we really smell the scent of a rose? How do our genes copy themselves with such precision? *Life on the Edge* accessibly reveals how quantum mechanics can answer these probing questions of the universe. Guiding the reader through the rapidly unfolding discoveries of the last few years, Al-Khalili and McFadden describe the explosive new field of quantum biology and its potentially revolutionary applications, while offering insights into the biggest puzzle of all: what is life? As they brilliantly demonstrate in these groundbreaking pages, life exists on the quantum edge. — Winner, Stephen Hawking Medal for Science Communication

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Customer Reviews

Praise for New York Times Bestseller *Life on the Edge* "Remarkable...*Life on the Edge* is a fascinating and thought-provoking book that combines solid science, reasonable extrapolation from

the known into the unknown, and plausible speculation to give an accessible overview of a revolutionary transformation in our understanding of the living world."

- Wall Street Journal "The elemental provocation of the book lies in the authors' ability to make the complex conceivable... McFadden and Al-Khalili give sure footing to the anything-goes bafflement of quantum theory."
- Kirkus Reviews "McFadden and Al-Khalili draw readers into a revolutionary new paradigm. . . An intellectually exhilarating visit to the baffling frontiers of science!"
- Booklist [starred] "The book elegantly opens up a new way of looking at nature."
- The Independent; "Books of the Year" "A really original science book about a new field of research ... Groundbreaking."
- Financial Times, "Books of the Year" "Coherence is just one of the complex phenomena that Jim Al-Khalili and Johnjoe McFadden set out to teach the reader. They succeed by using delightfully revealing analogies and similes, some borrowed from their prior work, that make slippery concepts sit still for study."
- The Economist "Hugely ambitious ... the skill of the writing provides the uplift to keep us aloft as we fly through the strange and spectacular terra incognita of genuinely new science."
- The Times (UK) "Physicist Jim Al-Khalili and molecular biologist Johnjoe McFadden explore this extraordinary realm with cogency and wit."
- Nature Magazine "This thrilling book is an overview of a field that barely exists ... Al-Khalili has a genius for illustrating complex ideas via imaginative sidetracks."
- The Sunday Telegraph "The great virtue of this book is its thesis ... it sets out a clear and enthusiastic argument for the importance of quantum biology."
- New Scientist "Life on the Edge gives the clearest account I've ever read of the possible ways in which the very small events of the quantum world can affect the world of middle-sized living creatures like us. With great vividness and clarity it shows how our world is tinged, even saturated, with the weirdness of the quantum."
- Philip Pullman "This illuminating account of an important new field is a wonderfully educative read."
- A C Grayling "From the Hardcover edition.

Johnjoe McFadden is Professor of Molecular Genetics at the University of Surrey and is the editor of several leading text books. For over a decade, he has specialized in examining tuberculosis and meningitis, inventing the first successful molecular test for the latter. He is the author of Quantum Evolution and co-editor of Human Nature: Fact and Fiction. Jim Al-Khalili OBE is an academic, author, and broadcaster. He is a leading theoretical physicist based at the University of Surrey, where he teaches and carries out research in quantum mechanics. He has written a number of

popular science books, including *Pathfinders: The Golden Age of Arabic Science*. He has presented several television and radio documentaries, including the BAFTA-nominated *Chemistry: A Volatile History* and *The Secret Life of Chaos*.

Quantum physics is certainly weird, but it isn't controversial any more. Quantum effects make technologies such as MRI possible. The authors do a good job of explaining the various physical quantum effects. The description of the famous two slit experiment is very clear in this book. Even though you find the results bizarre, you do understand what the results were and what they say about the quantum world. Quantum effects in biology do not seem bizarre. There is no additional weirdness, just quantum weirdness applied to minute biological processes. The authors focus on where and how quantum effects come into play, for example, in bird navigation or photosynthesis. The authors deal with the questions of why you need quantum physics rather than classical physics to explain specific results. They explain how a particular quantum effect achieves (or could achieve) a desired end. They explore how a tiny or animal cell can maintain quantum coherence (i.e. preservation of a quantum state necessary for quantum effects) long enough to allow the process to complete when physics labs cannot maintain quantum coherence for nearly as long despite massive equipment. Finally they explain how minute events can have a profound influence on living beings which are vastly bigger despite a general expectation in the scientific community that something tinier than a hair on a dog's tail could not possibly wag the dog. Aside from being easy and enjoyable to read, the book references published experiments and theoretical papers used in building up the narrative, including some papers which were published only months before the book was published. You get a feeling of observing the state of quantum biology just a few months ago. The authors also do a good job of showing what's speculative and what has been supported by research conducted in labs around the world. You end up feeling there is ample reason to believe that quantum physics plays an important role in biological processes.

This was an immensely enjoyable read. The approach that the authors took clearly showed that their discussion of quantum biology was not some theoretical musings but based on hard science. They would begin with current accepted ideas such as robins' ability to use the EM fields to navigate, to how the chlorophyll process work. They would then identify areas where there was no clear explanation of how certain processes worked such as the remarkable efficiency of the chlorophyll molecule to transfer virtually 100 % of the energy received to the reaction center. They then showed how certain quantum processes could be a useful area of research such as quantum superposition

states to explain for example the the remarkable energy transfer rates. They also made it absolutely clear all the way through the book that while quantum processes could explain many areas currently not understood, it was too early to conclusively say that the biological processes did make use of all the variety of quantum processes. The mark of serious scientists. They assumed that the reader had very little deep knowledge of molecular biology (thankfully!) or of basic quantum mechanics and made extensive use of analogies most of which were extremely helpful. This book is a great introduction to this new and expanding field of quantum biology and would recommend it to anyone fascinated by this subject.

Absolutely excellent. The best explanation of quantum mechanics ever and this from an undergrad business major with a master's degree in writing who dabbles in 'weird science' to stretch her brain (and to write convincingly--a factor she's not yet proven). I've recommended this to the very few people I know who also love the challenge of modern physics or those who simply cannot help themselves when it comes to weird science or those who thirst to understand the basis of life. Next time I'm in London, I'm going to look these guys up. A true wow! And also a bit gutsy, especially the ending.

Recently finished this book. It was very impressive. The authors revealed a life model on three layers of being: macroscopic, thermodynamic, and quantum microscopic. They revealed that the answer to the question of what is life may lie on this cross-layer being of life. Once the system lost its ability of riding this balance on its edge, life will become non-exist. This is a radical hypothesis about what life really is. The authors not only reviewed many studies about physics and biology, but also cited many other books and discussions on the topic of life. These cited materials also very helpful. I have since read several other books on the topic, and formed my own idea about what life is.

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