

The Quest for Consciousness: A Neurobiological Approach

By Christof Koch

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Consciousness is one of science’s last great unsolved mysteries. How can the salty taste and crunchy texture of potato chips, the unmistakable smell of dogs after they have been in the rain, or the exhilarating feeling of hanging on tiny fingerholds many feet above the last secure foothold on a cliff, emerge from networks of neurons and their associated synaptic and molecular processes? In The Quest for Consciousness, Caltech neuroscientist Christof Koch explores the biological basis of the subjective mind in animals and people. He outlines a framework that he and Francis Crick (of the "double helix") have constructed to come to grips with the ancient mind-body problem. At the heart of their framework is a sustained, empirical approach to discovering and characterizing the neuronal correlates of consciousness – the NCC – the subtle, flickering patterns of brain activity that underlie each and every conscious experience.

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The Quest for Consciousness: A Neurobiological Approach By Christof Koch Bibliography

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Editorial Review

From Scientific American
When he was still a student, Richard Feynman hinted at a career to come as a scientific wonderer when he wrote: "I wonder why. I wonder why. / I wonder why I wonder / I wonder why I wonder why / I wonder why I wonder!" Such wondering, and meta-wondering, takes us to the heart of what geneticist-cum-neuroscientist Francis Crick (who would know) calls "the major unsolved problem in biology"--explaining how billions of neurons swapping chemicals give rise to such subjective experiences as consciousness, self-awareness, and awareness that others are conscious and self-aware. The body of literature attempting to solve this problem is extensive, and getting one's mind around the field is a herculean task successfully executed by psychologist Susan Blackmore in her delightful introduction, Consciousness. Presented as a textbook, it is so highly engaging that I recommend it for general readers, too. In many ways, the book is structured like a brain, with loads of independent modules (boxes and sidebars featuring profiles, concepts and activities) tied together by a flowing narrative and integrated into a conceptual whole. The easy problem, Blackmore says, is explaining each of the functional parts of the brain, such as "the discrimination of stimuli, focusing of attention, accessing and reporting mental states, deliberate control of behavior, or differences between waking and sleep." In contrast, the hard problem in consciousness studies "is experience: what it is like to be an organism, or to be in a given mental state." Adding up all of the solved easy problems does not equal a solution to the hard problem. Something else is going on in private subjective experiences--called qualia--and there is no consensus on what it is. Dualists hold that qualia are separate from physical objects in the world and that mind is more than brain. Materialists contend that qualia are ultimately explicable through the activities of neurons and that mind and brain are one. Blackmore, uniquely qualified to assess all comers (she sports multihued hair, is a devotee of meditation, and studies altered states of consciousness), allows the myriad theorists to make their case (including her own meme-centered theory) so that you can be the judge. Making a strong case for the materialist position is Gerald M. Edelman's latest contribution, Wider Than the Sky, offered as a "concise and understandable" explanation of consciousness "to the general reader." Concise it is, but as for understandable, Edelman understates: "It will certainly require a concentrated effort on the part of the reader." As director of the Neurosciences Institute in La Jolla, Calif., a Nobel laureate and author of several books on consciousness (Neural Darwinism, The Remembered Present and Bright Air, Brilliant Fire), Edelman has impeccable credentials. But science writing for a general audience involves more than expunging scholarly references and providing a glossary of technical terms as a substitute for clear exposition. To wit, on memory Edelman writes that "it is more fruitfully looked on as a property of degenerate nonlinear interactions in a multidimensional network of neuronal groups." Such prose is common throughout the book, which is a shame because Edelman is a luminously entertaining conversationalist, and his theory that the brain develops in a Darwinian fashion of neuronal variation and selection, and that consciousness is an emergent property of increasingly complex and integrated neuronal groups, has considerable support from neuroscience research. An ideal combination of exquisite prose and rigorous science can be found in California Institute of Technology neuroscientist Christof Koch's The Quest for Consciousness. A rock climber adorned with a tattoo of the Apple Computer logo on his arm, Koch takes an unabashed neurobiological approach, the natural extension of what his longtime collaborator Francis Crick started in 1994 when he wrote in The Astonishing Hypothesis "that 'you,' your joys and your sorrows, your memories and your ambitions, your sense of personal identity and free will, are in fact no more than the behavior of a vast assembly of nerve cells and their associated molecules." To me, the most astonishing aspect of this theory is that it is astonishing to anyone. Where else could the mind be but in the brain? Nevertheless, finding the neuronal correlates of consciousness (NCC) has proved elusive, so instead of concocting a grand unified theory, Koch and Crick undertook a very specific research program focusing on

the visual system, to understand precisely how photons of light striking your retina become fully integrated visual experiences. Koch and his colleagues, for example, discovered a single neuron that fires only when the subject sees an image of President Bill Clinton. If this neuron died, would Clinton be impeached from the brain? No, because the visual representation of Clinton is distributed throughout several areas of the brain, in a hierarchical fashion, eventually branching down to this single neuron. The visual coding of any face involves several groups of neurons--one to identify the face, another to read its expression, a third to track its motion, and so on. This hierarchy of data processing allows the brain to economize neural activity through the use of combinatorics: "Assume that two face neurons responded either not at all or by firing vigorously. Between them, they could represent four faces (one face is encoded by both cells not firing, the second one by firing activity in one and silence in the other, and so on). Ten neurons could encode 210, or about a thousand faces.... It has been calculated that less than one hundred neurons are sufficient to distinguish one out of thousands of faces in a robust manner. Considering that there are around 100,000 cells below a square millimeter of cortex, the potential representational capacity of any one cortical region is enormous." Given that the brain has about 100 billion neurons, consciousness is most likely an emergent property of these hierarchical and combinatoric neuronal connections. How, precisely, the NCC produce qualia remains to be explained, but Koch's scientific approach, in my opinion, is the only one that will solve the hard problem.

Michael Shermer writes the Skeptic column for Scientific American and is publisher of Skeptic and author of The Science of Good and Evil (Henry Holt and Company, 2004).

Review
"An extraordinary book that outlines in clear terms the issues the biology of the mind will confront in upcoming decades." -- *Eric Kandel, Author of Principles of Neural Science and winner of the 2000 Nobel Prize for Physiology or Medicine*

"Once you start "The Quest for Consciousness" your mind makes you read through to the end as fast as possible." -- *James Watson, Author of The Double Helix and winner of the 1962 Nobel Prize for Physiology or Medicine*

"The Quest for Consciousness promises to be the most deeply informed and scientifically thoughtful book ever published on the subject." -- *Joseph E. Bogen, Clinical Professor of Neurological Surgery, University of Southern California*

"not only a mine of information, and full of provocative thoughts and insights, but a delight to read and ponder." -- *Oliver Sacks, Author of Awakenings, The Man Who Mistook His Wife for a Hat, and Uncle Tungsten*

About the Author
Born in 1956 in the American Midwest, Christof Koch grew up in Holland, Germany, Canada, and Morocco, where he graduated from the Lycèe Descartes in 1974. He studied physics and philosophy at the University of Tübingen in Germany and was awarded his Ph.D. in biophysics in 1982. He is now the Lois and Victor Troendle Professor of Cognitive and Behavioral Biology at the California Institute of Technology. The author of several books, Dr. Koch studies the biophysics of computation, and the neuronal basis of visual perception, attention, and consciousness. Together with Francis Crick, his long-time collaborator, he has pioneered the scientific study of consciousness.

Users Review

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In this 21st millennium, people become competitive in each and every way. By being competitive today, people have do something to make them survives, being in the middle of typically the crowded place and notice by surrounding. One thing that oftentimes many people have underestimated the item for a while is reading. Sure, by reading a publication your ability to survive enhance then having chance to stand than other is high. To suit your needs who want to start reading any book, we give you this The Quest for Consciousness: A Neurobiological Approach book as beginner and daily reading guide. Why, because this book is usually more than just a book.

Paul Blum:

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Mary Molinari:

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