brick wall. The same processes that fill in the blind spot (the "hole" in the eye we all have) are at work here, compensating for the loss with data from the surrounding regions. Like a kid discovering what can and can't be done with a new toy, Sacks describes the strengths and the limits of this filling-in. He can amputate his leg by moving it into his scotoma; yet when he wiggles and moves it, the sensory-motor feedback from what he can't see renders the leg visible in a ghostly sort of way. Conversely, a flock of birds that enters his scotoma abruptly disappears, only to emerge intact on the other side. His reaction to further operations and an abrupt bleeding into the weakened eye is to meditate on the loss of perceived depth associated with stereo vision.

Sacks is not a religious man. Yet when reading *The Mind's Eye*—most, but not all, of whose pages deal with disease, pain, or loss—the reader comes away with numinous feelings of wonder, mysticism, and gratitude. What more can one want from any book?

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MOLECULAR BIOLOGY

An RNA Whirl

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For anyone interested in understanding how life could begin, the new millennium has yielded a treasure trove of exciting discoveries. Research into the possible origins of life can be classified into three major themes, all of which have seen remarkable progress in recent years.

First, the right habitat and chemistry must exist. The past decade has seen the discovery of hundreds of exoplanets, and now several lines of evidence point to the presence of water on Mars, including liquid water in the past (*1*). In addition, chemical reactions that mimic prebiotic conditions exhibit remarkable selectivity under certain conditions, suggesting ways around the old bugaboo of nonspecific synthesis (*2*).

Second, order and reproduction must emerge through physical or chemical mechanisms. Recent work demonstrates how simple membranes can spontaneously self-assemble, grow, divide, and even compete with one another (*3*–*5*). Much progress has also been made on the old puzzle of the emergence of homochirality, which turns out to be remarkably easy: for example, simply grinding crystals of an amino acid can essentially convert a mixture to one-handedness (*6*). Still, many unexplored frontiers remain regarding the initial emergence of apparently biological properties.

Third, after the first replicating, information-carrying entities arose, Darwinian evolution took over as the dominant process that eventually led to the diversity of living organisms we see today. Promising work has been directed toward building primitive cells that could be capable of replicating and evolving. Although precise historical details of the particular origin of life on Earth are probably unknowable, most scientists agree that a world existed in which RNA performed the duties of both genes and enzymes. This RNA world in turn evolved into the DNA-RNA-protein world of today (*7*). Michael Yarus's *Life from an RNA World* offers an engaging introduction to the subject. Remarkably, as Yarus (a molecular biologist at the University of Colorado) points out, in the 1960s Leslie Orgel, Francis Crick, and Carl Woese each postulated an RNA world. They based their suggestions on the discovery that RNA could fold with structural complexity reminiscent of proteins. The theory provided an elegant solution to the chicken-and-egg mutual dependence of DNA and proteins for replication, but no one knew for certain that RNA could catalyze reactions. That was confirmed in the 1980s, with the discovery of the first ribozymes.

Many consider the structure of the ribosome—elucidated in 2000 and the subject of the 2009 Nobel Prize in chemistry—to be the smoking gun of the RNA world, because it demonstrates that catalysis of translation is performed by the ribosome's RNA component whereas the proteins serve primarily as a structural scaffold. Until recently, most researchers believed that several chemical features made RNA a suboptimal genetic material. Thus, people speculated that a simpler, more-robust nucleic acid preceded RNA. However, a recent elegant synthesis of ribonucleosides from prebiotic reactants has resurrected the idea that RNA might even have been the first genetic material (*8*).

The recent discoveries make Yarus's book particularly timely, especially as a light-hearted introduction for scientifically minded readers outside the field. His chatty prose conveys the voice of a tour guide on a journey through the RNA world, introducing essential evolutionary and molecular biology and pointing out must-not-miss attractions. Even members of the origins-of-life community may appreciate his whimsical explanations of familiar phenomena, and later chapters contain subtle material more suitable for specialists (e.g., direct physical interactions of amino acids with their codons and anticodons). Each chapter ends with a short but helpful reading list, which references authoritative reviews or books and research articles of special significance.

Life from an RNA World
The Ancestor Within
by Michael Yarus
Harvard University Press, Cambridge, MA, 2010.
208 pp. $24.95, £18.95, €22.50.
ISBN 9780674050754.

The author's discussion of how natural selection can lead to complexity is particularly eloquent. Although that topic has been dealt with in countless books intended for a broad audience, the continued rise of creationist sentiment signals an ongoing need for advocacy on behalf of evolution by natural selection. Yarus revisits classic evidence and thought experiments that demonstrate how complex structures (such as the eye) could evolve and why such structures are not irreducibly complex. Indeed, biological complexity is often in the eye of the beholder—our inability to intuit the path that led to a particular biological property should be taken by default as a reflection of our own limited intuition, not as the absence of a path. Natural selection is a powerful mechanism for carving paths toward apparently complex properties. At the earliest stages of life, before replicators came onto the scene, physicochemical mechanisms must have played this role. Building intuition and accumulating evidence for such paths remains one of the great intellectual and scientific challenges.

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