spond. As the program illustrates vividly, Russian prisons are an incubator for forms of the tuberculosis bacillus that could bring us the next pandemic. But to provide perspective, leaf-cutter ants have been agriculturists and using antibiotics for 50 million years without getting into this kind of trouble.

Other programs explore contemporary understanding of why organisms come in two sexes, ideas about the evolution of the human mind, and the new field of evolutionary psychology. Although even human behavior has been shaped by evolution in important ways, cultural evolution, lubricated by language, outpaces natural selection. Consequently, in the realm of culture—of ideas—"for the future of humankind, evolution may be no more than what we make of it." But as we continue to live in a world of organisms shaped by biological evolution, we need to understand better the consequences of our actions lest "what we make of it" is a complete mess.

Scientists who have ignored the political efforts to undermine the teaching of biology should be sure to view the final episode. "What about God?" addresses the politics of science education with unusual candor. Some of the scenes of conflicted high school students and their teachers are particularly compelling. At one level, the adolescents stir a measure of admiration for spunk as they urge the school board to harmonize biology with the different picture of the world they receive at home. But the deeper message, clearly understood by their anguished teachers, is that for these kids, at this age, it is close to impossible to teach them how science is different from faith. The scenes from Wheaton College, an interdenominational Christian institution, show the struggle unfolding with students who are a few years older. For some, hearing about evolution from a scientist who professes a strong religious faith can have more impact than all the evidence in the textbooks.

My one criticism of this coverage is that it may leave the impression that anti-evolutionists are all young-earth creationists. Such is not the case; anti-evolutionists occupy a broad theological spectrum and they are not all Christians. Moreover, as the courts have seen through the sham of "creation science," other "alternatives" to evolution have emerged. The latest, masquerading as cutting-edge science, is another echo from the past called "intelligent design theory." It asserts that the molecular machinery of cells is "irreducibly complex" and therefore requires a designer (unidentified). Hardly a theory in any useful meaning of the word, it is another example of what Richard Dawkins has called an argument from personal incredulity.

This PBS series may not change many committed minds, but viewers who approach it with curiosity will be rewarded by some intriguing views of evolution at work. For those who want to dig deeper, there is a richly illustrated and lucidly written companion book by Carl Zimmer.

BOOKS: NEUROSCIENCE

Beautiful Transfer of Information

Mary B. Kennedy

Information processing in the brain depends critically on the appropriate electrochemical transmission of signals from one neuron to another at synapses. Rapid progress in molecular and cellular biology over the last decade has fueled similar progress in our understanding of synaptic transmission; indeed our view of synapses in the brain has been transformed. In mid-1999, the Howard Hughes Medical Institute (HHMI) hosted a workshop on synapses; that gathering gave rise to the idea of a monograph summarizing recent progress. W. Maxwell Cowan, Thomas C. Südhof, and Charles F. Stevens (the recently retired HHMI chief scientific officer and two HHMI investigators) edited the resulting hefty volume. *Synapses* is comprehensive in its coverage. The quality of the writing and of the numerous beautiful color figures is excellent. Thus, the volume is a suitable textbook for an advanced graduate course as well as an authoritative reference for practicing neurobiologists.

Synapses
W. Maxwell Cowan, Thomas C. Südhof, and Charles F. Stevens, Eds.
Johns Hopkins University Press, Baltimore, 2000. 783 pp. $69.95, £48. ISBN 0-8018-6498-4.

Three introductory chapters set the remaining contributions clearly into context. To begin, Cowan and Eric Kandel offer an engaging history of the study of synaptic transmission from the first hints of its existence in 1791 through the 1970s. They choose to recount this history in light of two major controversies. The first revolved around the question, "Are neurons discrete cells or connected in a syncytium?" It was fueled by the limits of resolution of microscopy prior to the invention of the electron microscope. The denouement of the second, "Is synaptic transmission electrical or chemical?" also required better techniques. However, the answer, that both are important, shows that personal biases also stood in the way of a clear outcome. Controversy sometimes restrains progress in science instead of encouraging it. The chapter reveals another aspect of scientific sociology as well. The elegant studies of familiar early masters are recounted in detail, but many women who made crucial contributions are not mentioned. For example, the authors mention explicitly the description by Katz *et al.* of the postsynaptic membrane folds at the neuromuscular junction, "a region now known to be densely packed with [acetylcholine] receptors." We know about the packing of acetylcholine receptors at the top of the folds from the stunning work of Miriam Salpeter who invented quantitative electron microscope autoradiography to make this discovery, yet she is not cited. And the account of critical research on the *N*-methyl-D-aspartate channel names Mark Mayer, Gary Westbrook, and Philippe Ascher but omits Ascher's coauthor Linda Nowak. This informative chapter is a delight to read, but it reveals clearly how women's contributions tend to disappear.

The second chapter offers a richly illustrated account of the varied structures of synapses revealed in the electron microscope. It underscores the principle of cell biology that "structure underlies function." The authors raise an important question for the future: "What are the differing functions of brain synapses with obvious, if subtle, structural differences?" The third introductory chapter provides a lucid description of the basics of synaptic electrophysiology, emphasizing synapses in the central nervous system.

Chapters Four through Eight focus on the molecular organization and mechanisms governing the functions of the presynaptic terminal, the synaptic cleft, and the postsynaptic signaling apparatus.The chapters furnish elegant summaries of detailed working models of each organelle, demonstrating how the revolution in molecular biology has made its mark in neuroscience. At the same time, the authors point out the uncertainties in the models and, therefore, the most important questions remaining to be answered.

Five chapters cover the fascinating plastic properties of brain synapses. They recount the intense efforts to understand the baroque mechanisms by which the strengths of individual synapses are set and the roles of synaptic plasticity in brain development and memory storage. In addition to results from the molecular revolution, an explosion of new techniques in electrophysiology and fluorescence microscopy, driven by advances in materials science and the growth of computer power, have provided a wealth of new information in a relatively short time.

The volume's last two chapters point most strongly toward the future. Sol Snyder (with his charming iconoclastic style) and Christo-

The author is in the Division of Biology, California Institute of Technology, Pasadena, CA 91125, USA. E-mail: kennedym@its.caltech.edu

pher Ferris contribute an overview of novel neurotransmitters that underscores how much we still have to learn about molecular actions and physiological effects of several classes of neuromodulators that bathe synapses in the brain. These modulators include biogenic amines, numerous peptides, the gas NO, and the unusual amino acid D-serine. In the final chapter, my personal favorite, Joel Stiles *et al.* offer an account of the use of computer simulation to understand aspects of transmission at the neuromuscular junction. We have reached a crucial transition in the study of cell biology in general and synaptic function in particular. With the impending completion of several critical genome projects, the identification of new proteins is no longer a limiting step in understanding synaptic mechanisms. We can now focus on the exciting task of understanding how these proteins function together to endow synapses with their remarkable properties. An important aspect of this task is the development of new, more quantitative methods to explore and understand complex signaling pathways.

For both seasoned neurobiologists and interested newcomers to the field, this book is a worthwhile introduction to the wonders of synapses and the many opportunities for future study that they offer.

BOOKS: PUBLIC HEALTH

Despised Source of Whining and Worse

John Farley

Perhaps one clue to understanding this strange little book is revealed when the senior author, Andrew Spielman, a Harvard-based authority on mosquitoes and tropical diseases, relates how, as a young professor, he spoke to a reporter about discovering the presence of the mosquito *Culiseta melanura* at the Harvard Medical School. Although, as he told the reporter, there was no evidence that the mosquito was actually harboring the eastern equine encephalitis virus, of which it is a vector, the reporter had heard enough. The reporter's newspaper promptly created an uproar, and sold copy, by publishing "Brain Fever at Harvard." Is this experience why Spielman chose not to write this popular-style book alone, but to collaborate with Michael D'Antonio, a Pulitzer Prize–winning journalist? *Mosquito* seems to have been written by D'Antonio on the basis of oral interviews with Spielman; much of the text in the first-person singular expounds tales from Spielman's very full professional life.

Mosquito
A Natural History of Man's Most Persistent and Deadly Foe
by Andrew Spielman and Michael D'Antonio

Hyperion, New York, 2001. 267 pp. $22.95, C$32.95. ISBN 0-7868-6781-7. Faber and Faber, London. £10.99. ISBN 0-571-20980-7.

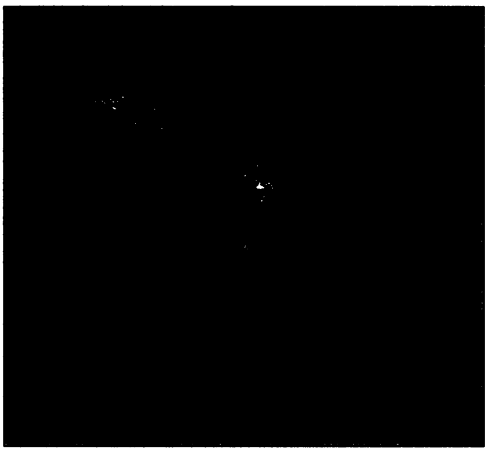
This collaboration may explain a certain tension one notes between Spielman's obvious fascination with the tiny mosquito and the journalistic desire to enhance book sales. Near the end of the book, the authors note:

> Posed against an enormously dangerous environment, this seemingly simple organism thrives. Everything about its design is economical and precise. And even though it is incapable of thought, it manages to meet great challenges, adapting to our use of pesticides, the loss of habitat, even climate change. Charles Darwin would have been amazed....

But such thoughts do not usually attract a large readership, and the authors face the additional hurdle that, as they explain in the preface, "it may be difficult to love the mosquito." Everything she does is self serving, neither aerating the soil nor pollinating plants. "She has no 'purpose' other than to perpetuate her species." Perhaps in recognition of the insect's lack of appeal, only the first fifth of the book deals specifically with mosquitoes. The remainder concerns the disease organisms for which they serve as a vector, with the emphasis on yellow fever, malaria, dengue fever, and the mosquito-borne viruses.

The authors spend far too many pages narrating how the vectors of these diseases were discovered and how attempts were made to control them by attacking the mosquito. Malariologists have told these stories before, often in a popular and entertaining form, in such books as Robert Desowitz's *The Malaria Capers* (Norton, New York, 1991) and Socrates Litsios's *The Tomorrow of Malaria* (Pacific Press, Wellington, New Zealand, 1996). The journalistic urge is also obvious in the book's subtitle, which appears on the dust jacket with the words "Deadly Foe" colored blood red. (Given that the book is directed at a U.S. audience who must be aware that the number of gunshot deaths in their country far exceeds those from mosquito-borne diseases, this clearly represents extreme media-hype.) The publisher chose too not to include a further reading list (it need not have been long) by which interested readers would be encouraged to delve further into the world of mosquitoes and disease.

Nevertheless, within the limited space available Spielman does his best to present a fascinating picture of the mosquito's life. He also succeeds in conveying how extraordinarily varied mosquitoes are. For example, even the blood intake to provide egg nourishment, which we all associate with female mosquitoes, "is actually something that the vast majority of female mosquitoes will never enjoy." Only a few species are able to feed on human blood, and many of those that do are able to turn readily to birds and mammals. However, I am not sure that such details will completely fulfill Spielman's wish that the book "will lead [readers] to respect and, perhaps, admire the mosquito as something more than just a pest or a vector of disease." His hope would have been better served had he written more on the mosquito and much less on the malaria wars.



Atypical biter. Unlike *Sabethes cyaneus*, most species of mosquito are unable to feed on human blood.

CREDIT: DAVID DENNIS/ANIMALS ANIMALS

Despite the book's shortcomings, its format does prepare the reader to understand and enjoy the grand finale: the bizarre story of the 1999 outbreak of West Nile fever in New York City, the episode that probably generated this particular book in the first place. This delicious story alone is worth the price of the book. Spielman shows how difficult it is for people like himself to conduct a rational campaign against a disease when one is faced by a press that sensationalizes everything and blows all out of proportion, to such an extent that West Nile fever has been made to sound like a 19th-century cholera epidemic; politicians who have to be seen to be doing something even if their actions are a total waste of time and the taxpayers' money; frightened mothers; organic gardeners; and extreme environmentalists who will fight against the release of a single droplet of pesticide. And it is clear that all of us should read Spielman's words in the final chapter, "Living with Mosquitoes," for we have no other choice.

The author is retired from the Biology Department, Dalhousie University, Halifax, Nova Scotia B3H 4J1, Canada.