ORNITHOLOGY

Sweet Bird Most Musical

Bernard Lohr

Sweet bird, that shunn'st the noise of folly,
Most musical, most melancholy!
–John Milton, *Il Penseroso*

Describing and deciphering the enormous variety and complexity of sounds that birds produce was Luis Felipe Baptista's lifelong passion. Sadly, Baptista, the curator of ornithology at the California Academy of Sciences, passed away in June of 2000, leaving the field without his keen enthusiasm and broad-ranging expertise. He was widely admired for his prolific research record, which included important contributions to the fields of song learning, conservation bioacoustics, and the parallels between birdsong and music. He also possessed a well-known desire to bring the sometimes arcane and highly technical arena of birdsong biology to a more general audience. After his untimely death, a large group of his many colleagues and friends convened a conference in his honor. *Nature's Music: The Science of Birdsong* grew out of that symposium.

Nature's Music
The Science of Birdsong
Peter Marler and Hans Slabbekoorn, Eds.
Elsevier Academic Press, San Diego, 2004. 543 pp. + 2 CD-ROMS. $74.95, £49.95. ISBN 0-12-473070-1.

The editors, Peter Marler (University of California, Davis) and Hans Slabbekoorn (Leiden University, the Netherlands), have drawn on contributors with a wide range of backgrounds and expertise. Marler, whose pioneering work helped establish and guide the study of birdsong as a discipline, starts the volume off with an overview of the field's history. Well-organized, comprehensive summaries of past and current progress on the topics of song learning in birds, the diversity and plasticity of birdsong, auditory perception, vocal production, and the evolution of avian song are provided by well-known experts in these areas. In addition, accomplished younger investigators contribute several of the 14 chapters. These include Slabbekoorn's review of the ecology of birdsong; Jeffrey Podos and Stephen Nowicki's chapter on performance limits, which elegantly integrates mechanism and evolution in the context of song diversity; and Erich Jarvis's discussion of the neurobiology of the songbird (oscine) brain, perhaps the most lucid account of current work in this intensively studied and intricate field.

A major attraction of *Nature's Music* comes in the form of scattered brief essays—48 in all—that offer details and perspectives from additional authors whose work bears directly on the issues at hand. Another highlight is the inclusion of two compact discs that contain samples of many of the sounds discussed in the text. Culled from audio archives (including those of the Cornell Laboratory of Ornithology and the British Library of Wildlife Sounds) as well as recordings by individual authors, such auditory examples are long overdue in a book of this type. I hope that future books will continue this welcome trend and perhaps even include DVDs with short video clips or affiliated interactive Web pages to facilitate firsthand glimpses of the study sites, species, and methodology of some of the systems and subjects under review.

The editors have made a concerted effort to balance the technical nature of the material with the desire to accommodate a more general audience. As a whole, the volume succeeds admirably, although some sections (particularly in chapters that consider questions of biological mechanisms) are still likely to be too specialized for general readers. Another minor shortcoming of the volume is the repeated description of some well-studied processes in birdsong. The developmental stages of song learning, for instance, are recounted in detail in no fewer than four chapters. Some redundancy, however, is unavoidable in a multi-authored volume, and the book generally strikes an excellent balance between brevity and thoroughness.

The contributors do not shy away from controversy. Donald Kroodsma, for example, issues a challenge to those who suggest large song repertoires are a consequence of sexual selection. Kroodsma remains unconvinced that existing direct experimental data demonstrate female choice for larger repertoires in a natural context. Although his criticism is general, he selects—as he did in an earlier critique of song playback designs—studies of other eminent birdsong biologists as specific examples. Because those researchers are more than capable of defending their conclusions and viewpoints, an interesting and vigorous debate is sure to ensue.

Nature's Music outlines a number of important areas for future work. Several contributors stress the need for a greater emphasis on comparative studies, especially in parrots, hummingbirds, and suboscine passerines—all groups now known to show at least some vocal learning. Several authors make a compelling case for renewed emphasis in the relatively neglected area of bird calls (usually shorter, acoustically simpler vocalizations) as distinguished from song; indeed, an entire chapter is devoted to this end. Calls occur in numerous contexts and were commonly thought to be nonlearned, although there is now ample evidence in some species to dispute this generality. Lastly, there is a need for a more intensive application of songbird studies to conservation efforts, particularly in the emerging field of conservation bioacoustics (pioneered in part by Baptista). Chapters by Sandra Gaunt and Archibald McCallum, Slabbekoorn, and Robert Dooling all address some aspects of this increasingly important issue, especially the use of song as an environmental indicator and the potential effects of noise on vocal signaling.

Melodic marvel. The tuneful notes of the musician wren (*Cyphorhinus arada*) inspire investigation into the complexity of birdsong.

CREDIT: EDSON ENDRIGO/AVESFOTO

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Future work on avian song must also grapple with the many contradictions and counterexamples that impede an easy explication of general principles. The challenge is to learn how exceptions to the rule—the "exuberant cacophony" or "exquisite nonstereotypy" of some birdsong—may enhance our understanding of the underlying mechanisms, developmental trajectories, adaptive functions, and evolution of song in birds. *Nature's Music* provides a comprehensive review of these issues and amply conveys the wide-ranging interests and enthusiasm about birdsong championed by Baptista. A fitting tribute to his science and mentoring, the volume offers a generally approachable yet complete and timely review of avian song.

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APPLIED PHYSICS

Shining a Light on Semiconductors

James R. Chelikowsky

In *The Story of Semiconductors*, John Orton attempts to tell you everything you ever might want to know about semiconductors: the science, the economics, the people, the culture, and the history. Of course, he cannot do all of this in any detail while keeping the book's size and scope tractable, but he does an excellent job in addressing most of these matters.

The Story of Semiconductors
by John Orton

Oxford University Press, Oxford, 2004. 522 pp. $54.50, £35. ISBN 0-19-853083-8.

The book shines when the author presents the "people" side of semiconductors. Orton, a semiconductor researcher who retired from the University of Nottingham, names names, gives dates, provides pictures, and recounts interesting anecdotal stories. He does so in a witty, informal, and eminently readable fashion. For example, the book contains a paragraph on the controversies surrounding Nikola Tesla and the development of wireless communications. Orton notes that in an 1893 lecture to the U.S. National Electric Light Association Tesla outlined all the features necessary for a wireless communication system, including the means to provide selectivity. Given that Tesla clearly pioneered these key ideas, why do histories of radio generally not credit him for his contributions? Orton starts with what some people probably already know: that Tesla was not a good advocate for this technology because he was commercially naive and reluctant to publish his research findings. What readers may not have previously realized is that Tesla's commercial benefactor at the time was someone not very interested in promoting wireless technologies. George Westinghouse "had a vested interest in AC power transmission along *wires* and was all too keen to keep Tesla's [wireless] work from reaching practical application!"

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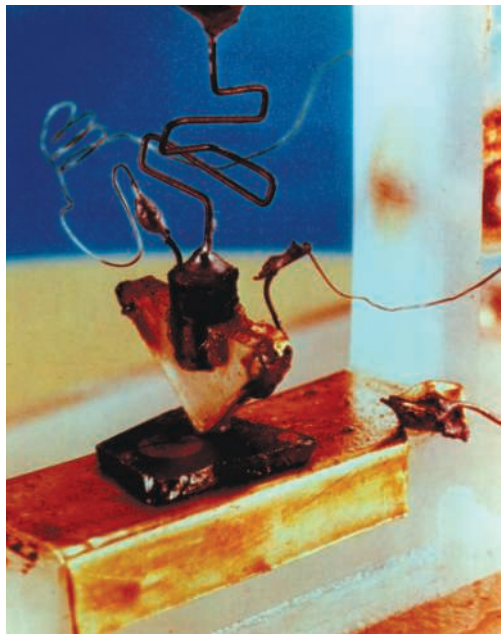

The first transistor (1947). To obtain power gains, Walter Brattain had to reduce the separation of the two metal point contacts on the germanium crystal to under 50 μm.

CREDIT: COURTESY LUCENT TECHNOLOGIES

Orton's technological history of semiconductor inventions includes many interesting details. Some are well known, such as the famous prognostication Gordon Moore, a founder of Intel, made in 1965—the prediction that the number of components on an integrated circuit would double every year. Moore's law has been largely obeyed for the past three decades (though Orton notes that the annual increase is actually about 1.6) and provides a reliable guide to the near future. But how many people outside of the field know Craford's law? As Orton explains, this law quantifies progress in developing the efficiency of light-emitting diodes: the luminous efficiency of such diodes should increase by a factor of ten each decade. Craford's law, like Moore's, has held for the past 30 years, but we are now approaching the limiting efficiency of 100%. A figure in the book charts the progress from the first light-emitting diodes of the early 1970s, based on GaAsP, to today's AlGaInP/GaP combinations. Readers are guided along the arduous path of how efficient light-emitting diodes were developed. Orton's account will disabuse anyone who believes that progress in materials synthesis and characterization is a minor issue in semiconductors. The light-emitting diodes of the 1970s were inefficient and had few applications, whereas—largely through materials advances—diodes now are routinely employed in traffic lights and will likely replace the incandescent light bulb.

The author is not timid about addressing some of the major economic and social issues surrounding such topics as the Japanese successes in the explosive development of the microelectronics industry during the 1970s. In seeking the key to the Japanese success when American start-up companies like Texas Instruments, Fairchild, Hewlett-Packard, and Intel were clearly a leading and innovative force, Orton recognizes the usual suspects. The Japanese government imposed a "controlled competition" on companies like NEC, Hitachi, and Fujitsu, and Orton contrasts this policy with the laissez faire or "uncontrolled warfare" of the American system. But he also claims that there was more to the Japanese success than government planning, factors such as the planning of product development within companies: "The essential philosophy was one of starting with a product which was perceived to be marketable and thinking backwards to define a research and development programme designed to realize precisely this." He goes on to strengthen his case by noting cultural circumstances such as the Japanese lifestyle and the urge to develop a "homemade" telecommunications industry.

If there is a shortcoming to the book, it lies in the discussions of the underlying science of semiconductors. To avoid an overly technical narrative, Orton has placed the more specialized and mathematical details in boxes of text and figures. He asserts that the book may be read without resort to these boxes, the main text being complete in itself. One suspects that this will not be true, save for those trained in the field. Of course, this complaint is a bit unfair. As noted in the preface, *The Story of Semiconductors* is not a substitute for a scientific text. It decidedly is not, but it is a fun book to read.

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