The Loss of a Lead

Innovating for Failure. Government Policy and the Early British Computer Industry. JOHN HENDRY. MIT Press, Cambridge, MA, 1990. xx, 240 pp. $35. History of Computing.

Hendry presents here "a case study of what has become known as the 'British problem': the chronic inability of British industry to convert exceptionally high levels of technological expertise into commercial success in an international marketplace." He focuses on the National Research Development Corporation (NRDC), established in 1949 to stimulate and sponsor industrial development of publicly held patents. During its first decade, under the direction of Lord Halsbury, the NRDC devoted the bulk of its resources to capitalizing on Britain's early lead in electronic digital computers and to establishing a computer industry capable of competing with American firms, foremost among them IBM. The effort failed. By 1960, the U.S. computer industry was a generation ahead in design and held an insuperable lead in the number and cost of installed computers, both worldwide and in Britain itself.

Working from the archives of the NRDC and of some of the firms, as well as from interviews with industrial participants, Hendry chronicles Halsbury's campaign to coax reluctant manufacturers to assume the risks of commercial development of the computer. Conservatism was the main opponent. Computer experts could not see beyond a small number of large machines for scientific computing. The tabulating-machine companies worried about the short-term problem of retaining their customers in the face of new intrusions by American punched-card machinery and could not see the promise of leapfrogging to electronic data processing. Elliott Brothers and Ferranti had their eyes on computers for process control but saw them as long-range projects for which they were not willing to take short-term risks. Sharing Lyons and Company's view that the medium-range future of computing lay in the "electronic office" (LEO), Halsbury tried to broker a series of marriages between electronics and tabulating-machine firms to compete with IBM's line. None lasted far beyond the exchange of vows. Similar efforts to stimulate production models of research machines, thus wedding universities and industry, met with no greater success.

Aiming at a gap in the current policy literature on innovation, Hendry concentrates on the response of individual firms to the policies Halsbury was pursuing. In a final assessment, he emphasizes the internal and external contradictions in the NRDC's mission that doomed Halsbury's efforts to failure. Since no one was eager to go into the computer business, he was always the suitor, cajoling industries into undertakings they themselves had no interest in pursuing or would not pursue on their own. Yet he could offer little incentive for them to do so. Operating with limited funds advanced by the Treasury against the time the NRDC would become self-sustaining through royalties (which it never did), Halsbury could only enter into joint ventures with industrial partners. Although he was willing to assume the bulk of the risk against a small share of the receipts, he could not help any of his partners to a substantial competitive advantage without compromising the "fairness" expected of a public agency. Moreover, and perhaps more important, the NRDC could exercise little control and oversight over a partner's operations. Hendry shows that, in case after case, when the goals of the NRDC conflicted with those of the firm, the firm took care of itself. "Because of its limited capital and nominal duty to break even," Hendry summarizes, "the NRDC was always reluctant to gamble on products, but the consequence was that it gambled, perhaps unwittingly, on organizations." It usually lost.

The "British problem" may go back to Samuel Butler, who turned an adage around to expound, perhaps unwittingly, a truth of commercial exploitation: "Invention is the mother of necessity." Characteristically, it was American entrepreneurs who grasped that truth and created, rather than waiting for, the demand for telephones, phonographs, automobiles, computers, and other consumer items that we now think indispensable to modern living. As Kenneth Flamm has documented in *Creating the Computer* (Brookings Institution, 1988) and Hendry reminds us, the foresight of American computer entrepreneurs was sharpened by massive government funding of research and development. Nonetheless, in their concern to anticipate the needs and tastes of customers, American enterprise overcame in practice the simplistic, linear concept of technology transfer as applied science that Hendry believes blocked the NRDC from the start. In bringing science to market, research and development go hand in hand, and some of the enterprise must be devoted to the "low-tech" that makes "high-tech" usable outside the laboratory.

This is a book well worth reading, not only for the light it sheds on the uncertain beginnings of one of the world's major industries, but also for the help it provides in thinking through current innovation policies. The story it tells is not a history the United States should wish to repeat.

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Invertebrate Sounds

Arthropod Bioacoustics. Neurobiology and Behaviour. ARTHUR W. EWING. Comstock (Cornell University Press), Ithaca, NY, 1989. x, 260 pp., illus. $35.

Insect sounds are highly conspicuous components of our acoustic environment, and they have long drawn the attention of biologists, poets, and others who have wondered how and why insects sing. These questions are the focus of this book. As the title suggests, the scope extends beyond the insects to include material on crustaceans and arachnids. Nevertheless, the bulk of the work discussed (and, indeed, the bulk of the work that has been done) concerns insects.

The study of bioacoustics is highly interdisciplinary, drawing on insights from physics, ethology, neurophysiology, genetics, ecology, and evolution. Ewing's aim is to bring together findings from these diverse disciplines, and in this he certainly succeeds. The book is organized into chapters on the biophysics of sound, specializations and mechanisms for sound production and reception, the neurophysiology of hearing and sound production, behavioral functions of sound, genetics and evolution, and techniques. The first and last chapters provide the uninitiated reader with the technical basics needed to appreciate the biological content of the other chapters, which are essentially compilations of selected findings. Within many of the latter chapters the organization is by taxon. Occasionally, this obscures similarities that might otherwise be apparent; for example, in the chapter on neuroethology of sound reception a more

explicitly comparative approach might have been used to great advantage.

The book is particularly strong in its treatment of behavior and evolution. Much of the author's own research has dealt with the mechanics of singing and the evolution of song. His expertise in these areas is clearly apparent in the insightful way he relates issues of behavioral function and evolution to the physical constraints imposed by the devices and media that insects must use for producing, transmitting, and receiving acoustic signals.

It is inevitable that in a survey of this sort there will be some gaps in coverage. Although there are a few citations to quite recent work (1988), most of the material covered dates from 1986 or earlier. It is surprising that a book subtitled "Neurobiology and Behaviour" omits discussion of the relatively recent, but highly germane, work that directly addresses the roles of identified auditory interneurons in whole-animal behavior (see, for example, Nolen and Hoy, *Science* **226**, 992 [1984], and Schildberger and Horner, *J. Comp. Physiol.* **163**, 621 [1988]). Another conspicuous omission occurs in the section on the genetics of *Drosophila* song, where there is no discussion of the possible role of the *per* gene, which was initially identified for its role in determining circadian rhythms, in setting the rhythm of the courtship song (Kyriacou and Hall, *Proc. Natl. Acad. Sci. U.S.A.* 77, 6729 [1980]). The latter work is currently the subject of some controversy and has been challenged by Ewing (*Anim. Behav.* **36**, 1091 [1988]). Nevertheless, rather than ignore the issue, it might have been preferable to present all sides of the story. Even with the limitations mentioned above, the approximately 500 references listed in the bibliography are a valuable resource (although they would have been more useful if more liberal use had been made of citations in the text).

In all, *Arthropod Bioacoustics* is a welcome book. It succeeds in bringing a diverse body of literature together with depth and breadth appropriate for its target readership of advanced undergraduates, graduate students, and biologists seeking a general introduction to this field. It would be excellent as a supplementary text in undergraduate or graduate courses in animal behavior, or as the primary text for a more specialized course in animal communication.

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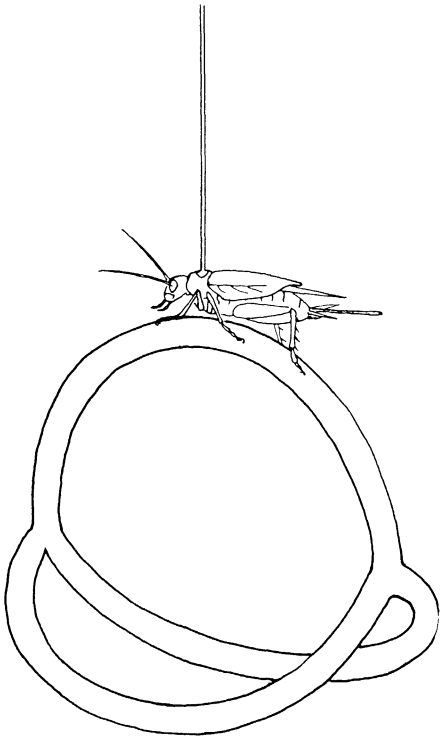

Tethered female cricket walking on an expanded polystyrene Y-maze. "Her phonotactic preferences can be assessed by analysing the choices she makes in response to songs played to her two sides." [From *Arthropod Bioacoustics*]

Ecology of Parasitism

Parasite Communities. Patterns and Processes. GERALD W. ESCH, ALBERT O. BUSH, and JOHN M. AHO, Eds. Chapman and Hall (Routledge, Chapman and Hall), New York, 1990. xii, 335 pp., illus. $89.50. From a symposium, Winston-Salem, NC, Aug. 1988.

Based on a symposium on helminth communities, this book is not just a collection of loosely connected essays but a well-integrated introduction to the community ecology of parasites, required reading for anyone working in ecology. Up-to-date and stimulating throughout, it presents an overview of patterns and processes in helminth communities, a discussion of host populations as resources defining parasite community organization, and discussions of communities of larval trematodes in snails and of helminth communities in marine fishes, freshwater fishes, amphibians and reptiles, and birds and mammals, as well as discussions of models for multi-species parasite-host communities and of hypotheses and pattern analysis in free-living communities and alimentary tract helminths.

The first chapter, by Esch, Shostak, Marcogliese, and Goater, is a concise and clear introduction to the terminology and the concepts of parasite community ecology. I know of no better outline of its kind. Nobody has done more to stimulate interest in the community ecology of parasites than Peter Price (*Evolutionary Biology of Parasites*, Princeton University Press, 1980), and in the second chapter, on host populations as resources, he outlines factors, such as host geographic area, density, and body size, that determine community patterns of parasites. He also includes a stimulating discussion of vacant niches. Price stresses that parasite systems must be included in syntheses of ecology, that parasitologists can take a leading role in advancing areas of ecology, and that "parasite community studies will become recognized as essential models for certain kinds of critical analysis" in ecology.

In the chapters on specific parasite communities, general background discussions are given together with detailed presentations of the ecology of those parasite species with which the authors are most familiar. This approach offers the reader up-to-date introductions to the relevant literature as well as discussions of current research, including methods used, and will be welcomed by students and research workers. An example is the chapter on parasites of marine fishes by John Holmes, well known for his experimental contributions to community studies of birds and mammals. After presenting an outline of knowledge of the ecology of marine parasites, he discusses his findings on helminths of *Sebastes nebulosus* in detail and compares them with those on other fish helminths, stressing aspects of community richness, predictability, host specificity, and determinants of helminth community structure in marine teleosts.

The various chapters cast light on the differences between helminth communities in different vertebrate classes. A. P. Dobson, in his chapter on models, emphasizes these differences and the necessity of further experimental work for a fuller understanding of coevolution and host-parasite relationships. Daniel Simberloff's critical approach to ecological questions shows itself in his comparison of free-living communities and intestinal helminths. He emphasizes the inadequacy of many statistical tests used to demonstrate species interactions in view of the difficulties in establishing valid null hypotheses: "Without experiment, even improbably low overlaps cannot strongly implicate the present action of competition" (compare *Evolutionary Theory* **8**, 305–350 [1989] on this point and others in Simberloff's discussion). Simberloff discusses competitive and reproductive character displacement as possible explanations for genetically determined non-overlapping niches and a third possible ultimate explanation of non-overlap, that the "genetic integrity of a species would make it difficult to be sufficiently flexible to occupy a large range of