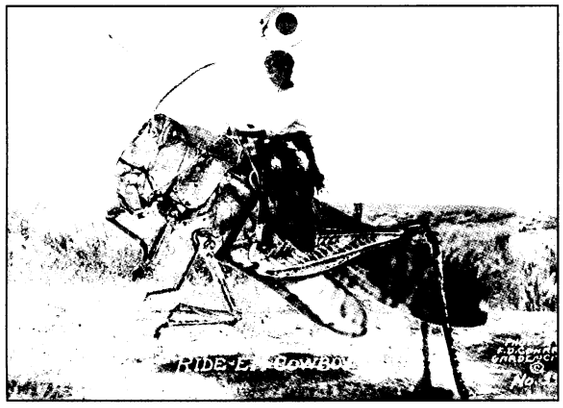
Inevitable Companions

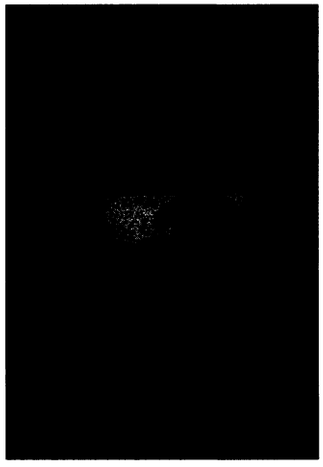
Bugs in the System. Insects and Their Impact on Human Affairs. MAY R. BERENBAUM. Addison-Wesley, Reading, MA, 1994. xvi, 377 pp., illus. $25 or $C31.95.

"The vast majority of people consider it a high priority to minimize the extent of their interaction with the insect world." Yet, May Berenbaum points out, there may be 10 quintillion individual insects on Earth at any one time, and they impinge upon our lives in so many (often unappreciated) ways that the effort to distance ourselves is "alas, an impossible one." I am reminded of Margaret Fuller's comment "I accept the universe" and Carlyle's rejoinder, "Gad! She'd better." There are bugs in the system, lots of them, and we had better accept them and learn how better to share the planet with them.

There is no better guide to the world of insects than Berenbaum, whose writing is as readable as a good novel and who has a quirky sense of humor all her own. Even this reviewer, who has had bugs in his system for more years than he cares to admit, found himself rewarded by choice and curious bits of information. I did not know, for example, that on a street in the nation's capital there is a nightclub called the Insect Club, where the menu includes mealworm won tons and cricket brittle. (But one need not go to Washington for such treats; there may be "as many as 56 insect parts in every peanut butter and jelly sandwich.") I was amused to learn that the first wife of Theodore Vassilyev had 69 children, including 16 sets of twins, 7 sets of triplets, and 4 sets of quadruplets. This is evidently the best humans have ever done to rival the fruit flies, a pair of which may start a cycle that could result in 10^{41} fruit flies by the end of a year.



"Turn of the century novelty postcard depicts a physiologically improbable scene." [From *Bugs in the System*]



Maeng dana, belostomatid water bugs, for sale in a market in Thailand. "In Asia insect-eating is widespread even today. . . . *Maeng dana* . . . in fact has made an appearance in California in import stores." [From *Bugs in the System*; photography by Alan Schroeder]

"Locusts blocking a train on the Athens-Salonika line." [From *Bugs in the System*; Department of Entomology, University of Illinois archives]

I was surprised to learn that the blossoms of cacao trees are pollinated primarily by minute midges, no-see-ems, without whose services we would not have one of the products that make civilization bearable: chocolate. And that Roman emperor Justinian, in A.D. 555, sent two monks to China to smuggle out silkworm eggs. The monks concealed the eggs in the staffs they carried as pilgrims and so provided the source of all the silkworms of Europe. Berenbaum adds that silk manufacturers in time developed punch cards that programmed their looms to weave particular designs. Thus evolved the digital computer, "the basis of the formation of IBM."

But I do not want to create the impression that this book is a collection of disconnected anecdotes. It is based on the author's course "Insects and People" at the University of Illinois. Thus topics follow logically, with much attention to recent research, in which Berenbaum has played important roles. Unlike many of today's scientists, she has not forgotten the history of her field. In fact the book could almost be read as a history of entomology. Many of the illustrations have been pulled from the archives, and herein lies my only caveat. A person not familiar with insect anatomy may be hard put to visualize, by mere words, what the elaborate mouthparts of insects are like, or the sensory organs and exocrine glands that are so important in guiding their actions. I expect that Berenbaum illustrates her lectures with slides, as so many of us do. She might have been more generous with visual aids here.

We hear a lot these days of the little things that make the world work: insects, fungi, bacteria, protists, and so forth. Where would we be without them? As human populations approach or exceed the Earth's carrying capacity, can we afford to ignore the roles they play in our diminished living space?

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Avian Advantage

Sexual Selection and the Barn Swallow. ANDERS PAPE MØLLER. Oxford University Press, New York, 1994. x, 365 pp., illus. $49.95 or £35; paper, $24.95 or £16.95. Oxford Series in Ecology and Evolution.

Its title notwithstanding, this book is not really about barn swallows. Put another way, it is no more about barn swallows than a study of *Drosophila* genetics is about the life of fruit flies. The book is not even confined to sexual selection in its narrow sense of reproductive competition; Møller uses barn swallows to examine virtually every important question in evolutionary biology. As he points out, "The process of sexual selection and the presence of secondary sexual characters affect in one way or another almost every aspect of the life of animals" (p. 319). The book touches on topics ranging from speciation to life history theory, with nods

along the way to foraging ecology, sex ratio evolution, migration, and the evolutionary consequences of geographic variation. In fact, the only major questions in evolution it does not address are why sex exists (presumably because swallows are not parthenogenetic) and the evolution of sterile castes and eusociality (because swallows are not cooperative breeders).

Swallows are abundant and relatively easy to observe and have a sexually dimorphic trait that is amenable to experimental manipulation: the forked tail, which is on average 17 percent longer in males than females in the Danish population Møller studies. With an ingenious combination of field experiments and painstaking observation, Møller looks not only at the immediate consequences to males of having a longer tail, namely higher mating success, but also at the long-term outcome of female preference. More ornamented males are more likely to copulate with females in addition to their mates; they and their offspring live longer and have fewer parasites than shorter-tailed males; and their mates tend to invest more in the offspring than do the mates of shorter-tailed birds. Some of these attributes appear to be genetic, as demonstrated by elegant cross-fostering experiments, whereas others can be emulated through the use of birds with artificially extended tails. With all of these advantages, you might ask, why don't all males have long tails and, for that matter, why isn't the tail itself even longer? Møller anticipates these questions with a chapter discussing the constraints on ornament evolution. Long tails are costly to produce and maintain, and only high-quality males can display them. Females choosing a long-tailed male can therefore expect to have high-quality offspring, but the difficulty of flying with such an unwieldy extension probably places an upper limit to tail length in these aerial acrobats.

These findings are always carefully generalized to animals other than barn swallows, which is why this book is not simply a narrow study of a single species. Møller displays a remarkable opportunism in his research, losing no chance to turn the smallest piece of information into a test of a hypothesis. For example, over the course of five field seasons lasting from six weeks to four months, he found 69 roadkill juvenile swallows. Most researchers would have passed them by; after all, that's less than one dead bird per week, not much of a sample size. Møller, however, took advantage of the birds' deaths to determine their sex via dissection of the gonads, male and female juveniles not being morphologically distinct, and used the information to look for bias in the secondary sex ratio. This dedication to detail is combined with a thorough grounding in theory throughout the book.

The book is not without its drawbacks. The writing style is terse and dry, albeit clear. It is sometimes difficult to tell when assertions are supported by data and when they are merely suppositions. The literature citations on sexual selection in other birds are rather scanty, especially with regard to empirical studies; this adds to the impression of a book about sexual selection that happens to use barn swallows as examples, but could leave the reader with the erroneous conclusion that little else has been done. Of course, as one of the most prolific authors in evolution and ecology today (12 single-authored publications cited for 1991 alone), Møller has ample scope for using his own work.

Like many others who study sexual selection, Møller focuses almost exclusively on males; chapter titles include "Male mating advantages," "Options for unmated males," and "Paternal care and male ornamentation," with no corresponding attention to females. This bias, though understandable because of the conspicuousness of the male ornament, nonetheless neglects the other key player in the sexual selection process. Some recent work in the field has attempted to redress this omission, and it is too bad more of the book is not directed toward that aim.

Perhaps some of the biologists using *Drosophila* or *Caenorhabditis elegans* in their research might consider a shift toward the graceful and utilitarian subject of this book; Møller has demonstrated an ample payoff from his attentions.

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Vignette: Stellar Physiology

Galaxies are of course the island universes within which reside most of the stars, much of the gas, and a little of the mass in the cosmos. *Activity in Galaxies*, like that in animals, is defined by the metabolic rate. When this is well above the average "resting" (aka. basal) level, a galaxy or animal is said to be active. For an animal of mass m kg, the mass-specific basal metabolic rate is about $m^{-1/4}$ cal $s^{-1}kg^{-1}$. . . . For galaxies, the mass-specific basal metabolic rate seems not to be strongly mass dependent, and is about $0.1 - 1\ L_\odot\ M_\odot^{-1}$ ($5 \times 10^{-6} - 5 \times 10^{-5}$ cal $s^{-1}kg^{-1}$; $1\ L_\odot\ M_\odot^{-1}$ is the average rate of energy release per unit mass of cosmic baryons which fuse 10% of their hydrogen in a Hubble time). Animal athletes, such as horses running the Kentucky Derby, can reach metabolic rates 20 times their basal rate. Galaxy athletes like quasars and extreme star bursts are even more impressive, reaching $\gtrsim 10^3$ times their basal rates ($\gtrsim 10^5$ times in selected regions).

—*E. S. Phinney*, in *Mass-Transfer Induced Activity in Galaxies* (Isaac Shlosman, Ed.; Cambridge University Press)

Books Received

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