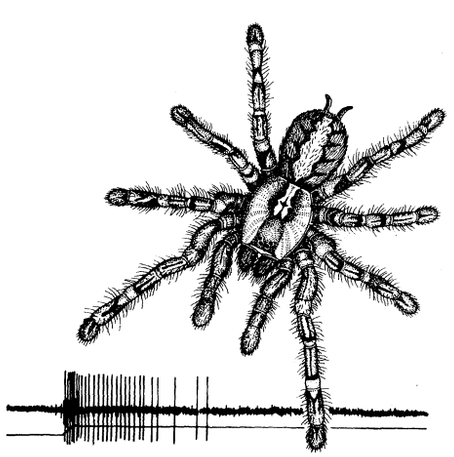
Book Reviews

Spider Neurobiology

Neurobiology of Arachnids. FRIEDRICH G. BARTH, Ed. Springer-Verlag, New York, 1985. xii, 385 pp., illus. $69.50.

Chelicerate nervous systems were last treated 20 years ago by Bullock and Horridge in their tome *Structure and Function in the Nervous System of Invertebrates*. Many of their data were distilled from Hanstrom's 1928 volume *Vergleichende Anatomie des Nervensystems der Wirbellosen*, which, for all its ground-breaking studies, contained neuroanatomy that was pretty rudimentary by modern standards. Thus it is gratifying that in the introductory chapter of *Neurobiology of Arachnids* the drawings of spider and scorpion nervous systems are convincing and the histological preparations show real structures. The editor has done a splendid job of recruiting many of the right names in arachnid neurobiology to write up-to-date accounts of their subjects. Most of the 18 chapters provide well-researched reviews as well as detailed accounts of each author's own work.

The book is distinguished by bountiful half-tone illustrations and a beautiful layout. It is divided into five sections, each dealing with a general topic such as sensory physiology, behavior, or motor control. The section on sensory systems is the most extensive. It contains some real gems, such as a chapter on physiological optics by Land and an impeccable chapter on retina organization by Blest that is ornamented by stunning electron micrographs of photoreceptor mosaics. Descriptions by Foelix and Barth (among others) of the various types of chemoreceptors and the marvelous variety of mechanoreceptors are lavishly illustrated and lucidly written.



The Puerto Rican spider *Cupiennius salei*. Beneath it is a spike train from a central neuron responding to mechanical stimuli. [From *Neurobiology of Arachnids*]

In a chapter on spider trichobothria, specialized vibration detectors, Reissland and Görner go to some lengths in describing the physical parameters of sound to support their contention that these sensilla are specialized for the kinds of airborne vibrations generated by a flying insect, the wind, and possibly predators. However, the paucity of relevant behavioral tests still leaves us in the dark about the significance of trichobothria in the life of the spider. By way of contrast, in a chapter on vibration perception Barth describes the role of the spider's most important receptor modality, which enables it to identify its mate, its prey, or its predator, and extends his description earlier in the book of the variety and significance of slit sensilla, which are placed at strategic areas of the body and limbs and which register substrate-borne vibrations or monitor the spider's self-generated strains and stresses during locomotion and so forth. What comes across very forcefully is not only the amount of research that has gone into morphological identification of the great variety of sensilla but also the ingenuity that has gone into the development of the biophysical methods that are used to identify and measure their function.

Forster nicely complements earlier chapters on spider optics and receptor organization with her chapter on the ethology of target discrimination by salticids. The chapter contrasts stylistically and philosophically with a chapter on spider navigation by Mittelstaedt, which represents the German school of behavioral cybernetics that employs the engineer's approach to predicting behavior and the construction of "wiring diagrams" in lieu of central nervous system analysis.

One obvious value of the book is that it lays a solid foundation for central nervous system research, which must in any event refer to the great quantity of data collected here on receptor organization. Until quite recently the major obstacle to such research had been the formidable problem posed by the internal pressure of the hemolymph, which is characteristic of this group. However, although not expressly stated in the book, Barth and his associates are making progress toward the kinds of electrophysiological studies that are commonplace on insects, using intracellular recording and dye filling. A chapter on circadian rhythms by Fleissner and Fleissner and one showing cobalt-filled neurons in scorpions by Root illustrate that arachnid nervous tissue is also amenable to standard tracer methods for neuroanatomy. The question is whether the book will persuade an established researcher to start a program on spiders. For the editor one incentive to proselytize (apart from his love of the Araneae) was the desire to promote comparative neurobiology. The book indeed suggests at least three areas in which research on the spider central nervous system may be particularly useful for studying problems that cut across taxonomic groups: the functional neuroanatomy of visuomotor control, neurohormonal control of circadian rhythms, and the intersegmental control of muscle coordination (for which the condensed nervous system of arachnids may be ideally suited). In this context it is a pity that the book does not contain a chapter on Land's observations of the locomotion of jumping spiders. And in a book that stresses the desirability of comparative neurobiology a chapter on *Limulus* would not have been misplaced. This chelicerate is of evolutionary relevance to the arachnids, particularly with respect to the general organization of its central nervous system. Its visual system and peripheral synapses bear comparison with those of scorpions and whip spiders, respectively.

Clearly the book fills a very obvious gap on the library bookshelf. It is said that the popularity of a book on neurobiology is inversely proportional to the number of legs represented. I hope that this handsome volume proves to be an exception, for it contains excellent neurobiology and some jewels of research.

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Interspecific Associations

Gulls and Plovers. The Ecology and Behaviour of Mixed-Species Feeding Groups. C. J. BARNARD and D. B. A. THOMPSON. Columbia University Press, New York, 1985. xii, 302 pp., illus. $30.

Every winter lapwings, golden plovers, and black-headed gulls meet in mixed-species flocks on the centuries-old pastures of Nottinghamshire to play a round in the survival game. Unlike the game of give and take Robin Hood played in a nearby forest when these pastures were young, gulls and plovers play a game of take and take in which giving is only coincidental. Recently another set of players has appeared on the scene. Armed with core samplers, event recorders, and binoculars, the new arrivals are not participants but observers; and their watching, recording, and digging have been aimed at finding out the rules of this annual