The characteristic forms of "action" were the staging of panel discussions, the issuance of statements, and the formation of societies that would stage discussions and issue statements, most notably the American Committee for Democracy and Intellectual Freedom. At their most radical Kuznick's activists formed an American Association of Scientific Workers, vaguely resembling a union or a party, which soon fell apart. The major theme was the need for scientists to come out of their ivory tower, assume social responsibility, show how to revitalize an ailing society—in sermonizing generalities, without getting specific enough to arouse much enthusiasm or antagonism. The crest of the activists' wave was a campaign for signatures on a statement that denounced Nazi racism and thought control. An estimated 10 percent of all American scientists put their names on that protest, and there was some truly activist fallout in the excision of obviously racist language from American schoolbooks. But, as Kuznick notes, there was nothing like a serious assault on the deeply ingrained racism of American institutions, not even the colleges and universities where the activist scientists worked. Nor, on the evidence Kuznick presents, did they do much or even think very deeply about capitalist depression or socialist remedies, whether of the Soviet or any other variety.

Kuznick wants to find the reasons why American scientists failed to break out of their "identification with the existing power structure." He believes that the "scientific community" was moving toward such a breakout but foundered on the problem of Soviet Communism, how to appraise it, how to relate it to American problems and possible solutions. I think he is mistaking a symptom for a cause. His scientist activists were few in number and weak in creative thought about America's major problems. Their vulnerability to destructive quarreling over an extraneous issue was more a result of that weakness than a cause of it. Incapable of serious debate about American problems—much less action to solve them—they pelted each other with buzzwords about a rumored solution to supposedly analogous problems in an exotic land.

That has been a persistent habit among the American public at large: using "Communism" as a conditioned stimulus for a flow of feeling rather than thought, whether about the United States or about the countries where Communism is a real issue. Kuznick pictures medical scientists as leading the way out of that mindless response to Communism. "The medical community," he declares, "carefully appraised the Soviet Union's pioneering experiment with socialized medicine," though his evidence shows nothing of the sort. Even if Walter Cannon and Henry Sigerist deserve credit for careful appraisals—it is wild exaggeration to call Sigerist's book on Soviet medicine "the definitive work"—Kuznick does not show that the American "medical community" at large made a serious effort to ponder its own problems in the light of Cannon's and Sigerist's reports on Soviet experience. Nor would they have found much of relevance if they had tried; the basic dissimilarity of the medical situation in the two countries is one of Sigerist's major lessons, whether or not he intended it.

We may feel respect for the activist scientists of the '30s even as we recognize the slightness of their achievement. After all, they had the double disadvantage of being scientists, members of a profession that makes a virtue of separation from politics, and Americans, citizens of a nation that likes to think its way of life is God's model for the world. Kuznick's subjects struggled in vain against those two obstacles to serious thought about their country's problems. Their chronicler would have deepened our respect for them if he had been less inclined to magnify their achievement, more concerned to disclose the cultural traditions that constrained and frustrated them.

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Rapid Radio Emissions

Superluminal Radio Sources. J. ANTON ZENSUS and TIMOTHY J. PEARSON, Eds. Cambridge University Press, New York, 1987. xvi, 361 pp., illus. $49.50. From a workshop, Big Bear, CA, Oct. 1986.

It has been clear from the earliest days of radio astronomy that most extragalactic radio sources consist of two regions of radio emission, typically many arc seconds apart and roughly symmetrically straddling the galaxy or quasar that is detected optically. In many cases there is also radio emission from this optical object, and with the advent of long-baseline radio interferometry it was often found that this central source is double on the milliarc-second scale (a few light years at the source), with the two components separated in the same direction as the outer ones.

An even more remarkable discovery, about 1971, was that the angular separation of the inner double sources is seen to increase at a rate that, with the traditional interpretation of redshift as a distance indicator, implies a linear separation speed well in excess of the speed of light: hence the term "superluminal radio source." The derived speeds depend somewhat on the values of some poorly known cosmological parameters (Hubble's constant and the deceleration parameter, which describe the scale and shape of the geometry appropriate to the universe); this means only that we are not sure whether the speeds are typically five or ten times the speed of light and does not affect the conclusion that the speeds are superluminal. There are currently about three dozen known examples of superluminal sources, and improvements in the techniques used to study them are not simply increasing their number but are providing remarkably detailed maps of their radio structure, in many cases revealing several components in the central radio source.

The most widely accepted interpretation of the phenomenon invokes an optical illusion produced by radiation sources moving at speeds that are (only just) below the speed of light, but almost directly towards us. The sources chase their own radiation, and the sideways motion appears to happen in a shorter time than is really the case. In addition, the high speeds "beam" the radiation and amplify it in our direction, thus favoring our detection of such sources, in spite of the small fraction of objects that might actually be moving in our direction. (This beaming mechanism was suggested before the discovery of the superluminal sources, in order to explain some other observed properties of radio sources.)

This volume reports the proceedings of a workshop honoring the 60th birthday of Marshall Cohen, who has made major contributions to the field through his involvement in the development of long-baseline interferometry and its use to find and study the superluminal sources. There is an excellent introduction to the whole subject by Pearson and Zensus, giving much of the background and including relevant beaming and cosmological formulas, and an equally good summary of the current observational situation by Porcas. The traditional concluding summary is provided by Blandford. The high standard of these contributions is maintained in the remaining papers; most are just a few pages long, but they are presented in a logical order that ensures continuity.

The interpretation of the superluminal sources in terms of simple beaming models is far from straightforward, and there are refreshing contributions by Barthel ("Feeling uncomfortable"), Rudnick, and others that remind us of this. One of Marshall Cohen's own contributions is a presentation and discussion of the relation between the

angular separation speeds of components in superluminal sources and the redshifts of the associated optical objects. The graph (appropriately reproduced on the cover of the book) shows the expected inverse correlation of these two quantities and illustrates their large scatter. It warns us that we are a long way from being able to determine any fundamental cosmological data from the observations at present, although given enough examples of superluminal sources and a better understanding of their behavior, the observations can in principle lead to the value of Hubble's constant. However, it is clear from this workshop that even if this hope is never realized, these sources are well worth studying for their intrinsic interest.

This attractively typeset volume provides an excellent survey of the current situation that will be valuable to all those who work on this subject. In addition, it will be a helpful introduction for both those entering the field and those merely interested in one of the more remarkable phenomena revealed to us by radio astronomy.

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Retinal Function

The Retina. An Approachable Part of the Brain. JOHN E. DOWLING. Belknap (Harvard University Press), Cambridge, MA, 1987. xiv, 282 pp., illus. $37.50.

The retina is our window on the visual world. Packed into its dense network are photoreceptors for transducing light into neuroelectrical signals, interneurons for performing computations on these signals, and ganglion cells for integrating the messages from interneurons and encoding them into sequences of nerve impulses that are sent deep into the brain for more analysis.

The retina takes the optical image formed on the photoreceptors by the cornea and lens and makes it into a neural image of activity across the mosaic of ganglion cells. The optical image is a spatial distribution of light energy, but the neural image is a distribution of impulse rates that represent contrast. Contrast is the local change in light divided by the average light level. The transformation from light to contrast depends upon retinal computations done by photoreceptors and interneurons.

A basic principle of retinal function is parallel processing of signals for brightness, darkness, and color. Some retinal ganglion cells are excited only by positive contrast (brightness) and others only by negative contrast (darkness). Still others respond to color contrast because they receive input from interneurons that subtract signals from two types of cone photoreceptor. Other basic principles of retinal function include temporal filtering, spatial filtering, and adaptation to light.

John Dowling's book is an approachable introduction to the function of the retina. Drawn mostly from his own investigations of the retinas of the monkey, mudpuppy, and skate, it illustrates principles of retinal function with numerous examples of retinal responses and functional connections between neurons. There are interesting chapters on the wiring of the retina, types of neuronal response, synaptic neurotransmitters and neuropharmacology, and visual adaptation and photoreception. There is an intriguing section in the synaptic mechanisms chapter on the neurotransmitter dopamine and its role in decreasing electrical coupling between retinal horizontal cells (a type of retinal interneuron). The book is illustrated profusely with figures of very high quality, especially the electron micrographs in the chapter on the wiring of the retina. There are also well-prepared summary diagrams of retinal cell types and connectivity and an appendix of basic concepts and terms in neurobiology. These features will make the book useful and attractive to students.

Some subjects, for example information processing and photoreception, receive less attention and space than others, like synaptic ultrastructure and neurotransmission. This is presumably the result of the author's decision to write about what interests him most. It makes the book less comprehensive but gives it a personal style that should appeal to many readers.

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Behavioral Evolution

Evolutionary Genetics of Invertebrate Behavior. Progress and Prospects. MILTON DAVIS HUETTEL, Ed. Plenum, New York, 1986. x, 335 pp., illus. $59.50. Based on a colloquium, Gainesville, FL, March 1983.

Despite the lag between conference and publication, this is an important volume and one that I would strongly recommend, especially to students beginning doctoral research in the evolution of behavior whether studying invertebrates or not. The book is organized into five major sections that cover the central concepts as well as the methods of modern behavioral research. Three of these sections are concerned with behavioral variation in natural populations: nonreproductive behavior, courtship and mating, and strategies for the success of progeny. The last two sections address problems in the molecular and biochemical genetics of behavior and theoretical questions concerning behavioral evolution. Many of the authors have taken advantage of the colloquium format to present somewhat more expository discussions of their research than might be contained in the average journal article. On the whole, it is this aspect of the volume that makes it particularly instructive and timely.

Several major themes recur throughout the collection, including territorial and aggregation behavior of spiders, the role of oviposition preferences and habitat choice in host race formation, and the relationship between behavior and speciation. The arachnid studies are surprising in several respects. First, they illustrate the potential of spiders as research tools in behavior genetics and how that potential is being realized. The papers of Reichert, Uetz *et al.*, and Stratton and Uetz and the bibliographies therein are a fairly comprehensive review of behavioral genetic research with this fascinating and relatively abundant group. Second, these three contributions document the existence of significant geographic variation in complex behaviors, such as courtship and territoriality, that are the focus of considerable current research in ecology and evolutionary biology. Questions that are intractable in many species of birds and fish can be answered with spiders. Last, and perhaps most surprising, is the evidence that spiders are fairly tractable subjects for the genetic analysis of behaviors and that at least some of the observed geographic variation has a genetic basis.

Habitat choice and oviposition preference and their relationship to host race formation are addressed in six papers. In particular, the experimental studies by Lofsdahl and Via of the cactophilic *Drosophila* and leafminers, respectively, and the theoretical contribution of Futuyma provide an incisive review of the most important questions involved in host-related divergence of phytophagous insects as well as the most powerful empirical methods for tackling the central issues. McCauley's paper on mating success in milkweed beetles is worthy of special mention because it adapts recent measures of sexual selection to facilitate their application to mark-recapture data, one of the most frequently used ecological tools.

In summary, this collection of papers is a