scant sample of this recording and represent editorial preference more significantly than the actual concerns of the fieldworker photographers. Nevertheless, a strong pattern of initial photographic "vision," as well as of editorial selection, can be discerned.

In part the illustrations tell us where the anthropologists' eyes were looking. Overwhelmingly the camera was turned to detail rather than whole relationships. To be sure, there are ten stunning aerial photographs of Zinacanteco communities, some of which are accompanied by excellent drawn maps showing settlement pattern. But there is not one ground-level view of a community, and out of nearly 150 photographs only some 15 show us enough surrounding background to suggest the shape and the ecology of the Indians' world and how it looks to Indian eyes.

Sociometrically this narrow view is found again. In all the scenes of social and religious life only 23 photographs are wide enough in field to allow the reader to make inferences concerning the social structure. Usually the camera is too close to show us how the Indians relate spatially by role or status. (As if aware of this shortcoming, the author has included copious diagrams of social structure and the exact positioning of religious happenings.)

Ethnographically, the photography is generally oriented toward details of artifact and technology rather than toward human behavior. There are many more photographs of tools and processes than of scenes revealing child development or of human relations in the home.

Behind these visual limitations probably lies a methodological neglect of photographs as data as compared to illustration. While both Vogt and George Collier used aerial photographs for direct research in community surveys of settlement and land use and have given exciting papers on the opportunity such photographs present, ground-level photographs were not, to my knowledge, similarly used. Had they been, the quality and coverage of the photography might have been quite different. Indian informants successfully read and gave insights into the community from aerial photographs. How much more they might have read from more intimate records of home, social, or ceremonial circumstances.

Aside from these reservations concerning the visual anthropology, *Zinacantan* is a richly illustrated work. The photographs—most of them the work of Frank Cancian with significant contributions by John D. Early and Mark L. Rosenberg and a few by other fieldworkers—allow us to relate warmly with the Indians. We see the Zinacantecos as intelligent, responsive, and delightful people. In this respect we can only compare this study to Robert Gardner and Karl Heider's *Gardens of War* or, much earlier, Miguel Covarrubias's creatively illustrated work on Java.

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The Isoptera

Biology of Termites. KUMAR KRISHNA and FRANCES M. WEESNER, Eds. Academic Press, New York, 1969–70. 2 vols. Vol. 1, xiv, 600 pp., illus.; vol. 2, xvi, 648 pp., illus. $32 each.

The insect order Isoptera, or termites, originated over 100 million years ago from cockroach-like ancestors. They acquired symbiotic, cellulose-digesting protozoans in their guts and, thus accoutered, were able to organize into tight little family groups devoted to the enterprise of extracting energy from dead vegetation by reducing it to piles of lignin dust. Termites rival the ants in diversity and their degree of specialization for social life. The great mounds of the African fungus-growing species are, for example, elaborately constructed in a way that insures fresh air conditioning in the living quarters. Hot air rises into the central flue near the top of the nest and passes laterally to a honeycomb of flat galleries located next to the outer nest wall; and as it cools, it drops to cellar-like chambers beneath the living quarters. A human engineer allowed only the use of the same building materials would be considered brilliant to come up with a structure as efficient. Such feats of coordination among thousands or millions of colony members are made possible in part by the existence of richly diversified caste systems. My favorite example of extreme specialization is in the soldier caste of *Globitermes*, the body of which is half filled with a gland containing sticky defensive fluid. When defending the nest against intruders the insect often turns into a living bomb—by contracting its abdomen violently, rupturing the body wall, and spraying its adversary with the gland contents. Similar instances of suicidal behavior on behalf of the colony are commonplace in termites, as well as in other social insects. Their existence is but one of several ways by which the behavior of these insects differs fundamentally from that of their solitary relatives.

The time is right for a new synthesis of termitology. The literature has grown to about 7000 titles, and although the annotated catalogs and taxonomic lists of Thomas E. Snyder have been invaluable aids during the past 20 years, the need for a full-dress review of the subject in the language of modern biology is obvious. The two volumes of *Biology of Termites* fill the gap more than adequately. The contributions of the 24 authors vary from exhaustive to sketchy, and from highly professional to amateurish. The editors could perhaps have done no better; their collaborators are for the most part the leading specialists in the world on their respective topics. Certain contributions are worth singling out because they treat rapidly developing subjects and present original viewpoints. These include exocrinology (C. Noirot), communication (A. Stuart), colony foundation (W. L. Nutting), caste (E. M. Miller and C. Noirot), biochemistry (B. P. Moore), and symbiosis with fungi (W. A. Sands). Among the more disappointing chapters is one by D. H. Kistner on termitophiles. The treatment is limited principally to the symbiotic staphylinid beetles. Although it provides a useful updating of Kistner's own studies of these organisms, the vast amount of published information on other groups, much of it of high quality and fascinating in the extreme, deserves a more balanced review. It is hoped that the author will provide us with one at a later date. Volume 1 is devoted wholly to the biology of termites, especially their anatomy, physiology, and behavior. Volume 2 is mostly, but not exclusively, concerned with a region-by-region survey of the classification and distribution of termites, an effort which, in conjunction with Snyder's *Catalog of the Termites (Isoptera) of the World*, will make taxonomic research much easier in the future than is the case for most other insect orders.

For the most part, *Biology of Termites* is a thorough and well-written treatise which will form the needed

platform for accelerated research on these insects in the future. Each of the contributors has made it clear that his special topic offers abundant opportunities for young entomologists who wish to concentrate on a group of insects that are both economically important and exceptional in the intellectual challenge they provide.

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Neuronal Processes

Cellular Dynamics of the Neuron. A symposium, Paris, 1968. SAMUEL H. BARONDES, Ed. Academic Press, New York, 1969. xiv, 386 pp., illus. $19.50. Symposia of the International Society for Cell Biology, vol. 8.

The increasingly successful application of the methods of modern cell biology to nervous tissue strengthens the view that we may eventually bring to bear upon the brain, in spite of its bewildering complexity of structure and function, the full power of modern biology with its sophisticated grasp of biosynthetic processes, ultrastructure, and genetic control. This book provides a good insight into cell biological approaches to some of the central problems of neurobiology.

The volume begins by considering the phenomenon of axonal flow and the more general question of the sites of biosynthesis of proteins and other macromolecular constituents of the neuron. P. A. Weiss reviews the history of axonal flow studies and introduces the reader to the now widespread observation that there are at least two distinct rates of axonal flow, separated by one or two orders of magnitude. S. H. Barondes describes the slow flow of soluble protein synthesized in the cell body to nerve endings in the mouse brain. J. Zelená describes with the electron microscope the rapid accumulation on *both* sides of a crushed portion of nerve of vesicular and other particulate elements. This observation, also reported by A. Dahlström, raises the important question whether there is normally some reverse flow of material toward the cell body. However, in agreement with the view that most material flowing down the axon originates in the cell body, the accumulation on the proximal side of the crush continues for some time after that on the distal side ceases. Dahlström's paper emphasizes three other aspects of axonal flow in sympathetic nerves: (i) different proteins constitute the fast and the slow flow; (ii) peripheral and central nerves appear to differ by more than fivefold in the rate of fast axonal flow, and this difference is related to the amount of material in the synaptic field that must be replaced; (iii) the cell body may have to manufacture its own content of fast-flow material in as little as two hours. The papers of both Weiss and F. O. Schmitt consider the mechanism of axonal flow. Weiss describes the limitations imposed on the choice of a mechanism by hydrodynamic considerations. Schmitt suggests a "sliding vesicle" model for fast axonal flow which attributes a central role to the neurotubules that are found in axons. Direct evidence for this mechanism is provided by Dahlström, who shows that colchicine, which depolymerizes the microtubules, does block the rapid movement of noradrenaline storage granules.

As to the question of cellular sites of macromolecular synthesis, B. Droz and H. L. Koenig describe the kinetics of biosynthesis of protein in the neuron soma by means of electron microscopic autoradiography. A. Edström presents evidence that there is three times as much RNA in the goldfish Mauthner cell axon as in the cell body, and that newly synthesized protein and RNA appear in the axon even in the absence of the cell body. Barondes describes the rapid appearance in nerve endings from whole mouse brain of macromolecules labeled with glucosamine, which he attributes in part to local modification of preexisting glycoproteins.

One of the major advances in cellular neurobiology has been the success in isolating synaptosomes, pinched-off nerve endings with some postsynaptic membrane frequently attached. A second major topic of this volume is the biochemical organization of such synaptic endings. The contributions of R. M. Marchbanks and of M. Israel and J. Gautron describe the localization of acetylcholine, choline acetylase, and acetylcholineesterase in isolated synaptic endings. Dahlström reviews the general organization of the noradrenergic neuron and nerve endings; her paper serves to emphasize both the similarities and differences in the organization of cholinergic and adrenergic synaptic endings. J. Taxi and B. Droz describe electron microscopic autoradiography showing accumulation of labeled monoamines in synaptic endings which contain dense core vesicles. E. DeRobertis describes the isolation of the "junctional complex" that is thought to contain the receptors for chemical neurotransmitters on the postsynaptic membrane and presents evidence that the receptors are proteolipids.

A third major topic of this book is treated under the heading Functional Implications of Synaptic Ultrastructure. E. G. Gray presents correlative evidence that round vesicles and tight synaptic junctions are characteristic of excitatory nerve endings and that flattened vesicles indicate certain types of inhibitory contacts. N. Chalazonitis examines the interaction of vesicles with the unit membrane of the nerve endings. K. Akert and K. Pfenninger describe a staining procedure with bismuth iodide which shows clearly the material lying on both sides of the synaptic junction and within the junction itself. J. Szentagothai and J. Hamori emphasize the dendritic aspect of synaptic junctions and describe dendritic "spines" and "digits."

The ultimate aim of much neurobiological investigation is to examine environmentally induced alterations in the structure and biochemistry of the nervous system, and this is the final topic of the volume. M. J. Cohen describes the striking changes in RNA of the neuron soma of cockroach thoracic ganglia which accompany nerve section and shows how this has provided a mapping procedure for this nervous system as well as led to fascinating cross-innervation experiments. R. Levi-Montalcini and J. S. Chen describe the behavior of the embryonic cockroach nervous system in organ culture, showing in particular the interaction of growing neuron cell bodies and nerve fibers with glial cells, which suggests some kind of functional interdependence. J. Szentagothai and J. Hamori describe ultrastructural changes in synaptic complexes which accompany visual deprivation, crossed cerebellar atrophy, and postnatal destruction of cerebellar granule cells. G. Filogamo describes histological and chemical alterations in nerves accompanying intestinal hypertrophy and interference with neuromuscular development. H. Hydén and P. Lange describe alterations in amino acid incorporation and in the electrophoretic pattern of soluble protein of hippocampal neurons which accompany training of rats in an appetitive motor task.

The almost inevitable delay in publi-